

Volume 10, Issue 1 (VI)

January - March 2023

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 10, Issue 1 (VI): January – March 2023

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Scientific Journal Impact Factor

CERTIFICATE OF INDEXING (SJIF 2022)

This certificate is awarded to

International Journal of Advance & Innovative Research
(ISSN: 2394-7780)

The Journal has been positively evaluated in the SJIF Journals Master List evaluation process
SJIF 2018 = 7.46

SJIF (A division of InnoSpace)

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CONTENTS

Research Papers

- A STUDY ON THE EFFECT OF YOGA TRAINING ON BREATH HOLD CAPACITY** 1 – 3
Prof. Brij Bhushan Singh and Shubi Mirja
- ORDERING COST REDUCTION DEPENDENT ON LEAD TIME IN A CONSTRAINED PROBABILISTIC BACKORDERS INVENTORY MODEL** 4 – 14
S. Hemalatha and K. Annadurai
- ENHANCING THE PRODUCTIVITY OF GREEN GRAM THROUGH LAND CONFIGURATION AND NUTRIENT MANAGEMENT IN SODIC SOIL** 15 – 19
Dr. S. Anandha Krishnaveni and N. Karikalan
- EFFECT OF 12 WEEKS OF MEDITATION ON HEART RATE VARIABILITY OF COLLEGE GIRLS** 20 – 23
Brij Bhushan Singh and Samiya Husain
- EXPLORING THE RELATIONSHIP OF SERVICE QUALITY WITH MODERATING IMPACT ON A GENDER. A STUDY OF FIVE-STAR HOTELS RESTAURANTS IN DELHI-NCR.** 24 – 30
Omar Abdullah, Dr. Tahir Sufi and Dr. Sanjeev Kumar
- INDIAN TRIBAL FOLK ARTS AND ITS SIGNIFICANCE** 31 – 39
Apurva Narendra Thosar
- IMAGE ENCRYPTION BASED VISUAL CRYPTOGRAPHY SCHEME IN SECURED DIGITAL TRANSMISSION SYSTEM** 40 – 43
Indresh Agrawal and Dr. Jaikaran Singh
- SECURE IMAGE ENCRYPTION BASED VISUAL CRYPTOGRAPHY SECRET SHARING IMAGE** 44 – 48
Indresh Agrawal and Dr. Jaikaran Singh
- A REVIEW OF MACHINE LEARNING IN BIG DATA ANALYTICS: APPLICATIONS, CHALLENGES, AND PROSPECTS** 49 – 57
Dr. K. S. Gomathi and Ms. R. Mahalakshmi
- WEB DISCOVERY TOOLS: CONCEPT AND CHALLENGES** 58 – 62
Hilala Ariyana and Dr. Bhoop Singh

MATHEMATICS FOR SUSTAINABLE DEVELOPMENT	63 – 66
<i>Dr. Garima Sharma</i>	
ON THE PROBLEM OF MODELING SURFACE AND DEEP STRUCTURES OF ENGLISH COMPOUND TERMS OF THE "INFORMATION RETRIEVAL" DOMAIN	67 – 70
<i>A. A. Shvetsov and I. O. Shevkoplyas</i>	
WOMEN AND ENTREPRENEURSHIP: FACTORS AFFECTING GROWTH OF WOMEN ENTREPRENEURS	71 – 76
<i>Dr. G. Kavitha and Lakshmi Narendran</i>	
PHLEBOTOMY: BEST CLINICAL PRACTICES	77 – 82
<i>Dr. Shashi Dhar Mehta and Sandhya S. Mehta</i>	
AN EVALUATION OF SOME TRADITIONAL HERBAL PLANTS USED IN MANAGEMENT OF MEMBRANE DISEASES	83 – 86
<i>Harshada V. Wagh and Dr. Pankaj M. Chaudhari</i>	
A COMPARATIVE ANALYSIS OF TEXT DETECTION TECHNIQUES IN SCENE IMAGES	87 – 92
<i>Rashi Gupta and Javed Wasim</i>	
MULTIDISCIPLINARY RESEARCH TOWARDS SUSTAINABLE DEVELOPMENT	93 – 96
<i>Dr. Laxmi Sharma</i>	
REVIEW OF APPLICATION OF PRECAST CONCRETE CONSTRUCTION FOR WATER RESOURCE ENGINEERING	97 – 107
<i>P. D. Patil and I. P. Sonar</i>	
RISK LANDSCAPE OF CLOUD COMPUTING	108 – 112
<i>Dr. Sasikala P, Prof Mary Immaculate Sheela L and Prof. Kwame Boasiako Omane-Antwi</i>	
ENERGY EFFICIENT TECHNIQUES OF 5G USING MILLIMETER WAVE WIRELESS COMMUNICATIONS	113 – 120
<i>Shobhna Mishra and Dr. Jaikaran Singh</i>	
ENERGY EFFICIENT TECHNIQUES OF 5G MILLIMETER-WAVE CELLULAR ACCESS NETWORKS ANALYZE THE COVERAGE PROBABILITY WIRELESS NETWORKS	121 – 125
<i>Shobhna Mishra and Dr. Jaikaran Singh</i>	
A TECHNICAL ASSESSMENT OF PNEUMATIC CONVEYING OF RICE HUSK WITH RESULTS FROM A CONVEYING FLOW LABORATORY TEST	126 – 129
<i>J. Phani Krishna, Kiran Barade, Rohan Kulkarni and Siddesh Abhang</i>	
CHANGING DYNAMICS AND TRENDS OF ENTREPRENEURSHIP	130 – 136
<i>Dr. Vishwas Iresh Swami and Ms. Deepa Naidu</i>	

IMPACT OF MEDITATION ON BLOOD PRESSURE OF COLLEGE GIRLS	137 – 140
<i>Brij Bhushan Singh and Samiya Husain</i>	
WORKING CAPITAL MANAGEMENT AND PROFITABILITY OF STEEL COMPANY	141 – 144
<i>Priyanga V and Dr. S. P. Mathiraj</i>	
SURVEY ANALYSIS USING NLP	145 – 148
<i>Rohan Awale, Pranav Meshram and Pushpa Tambe</i>	
ECO-FRIENDLY SYNTHESIS, STABILITY AND BIOLOGICAL EVALUATION OF MN(II)-A-AMINO ACID COMPLEXES	149 – 157
<i>K. P. Srivastava and Anuradha Singh</i>	
ASSESSMENT OF THE SUSTAINABILITY OF SUGARCANE PRODUCTION. GLOBAL TREND	158 – 164
<i>Gabriel Chico Viegas and Ana Alexandra Marta-Costa</i>	
INDIGENOUS KNOWLEDGE MANAGEMENT SYSTEMS (IKS): ZIMBABWE'S SUSTAINABLE GROWTH STRATEGY	165 – 172
<i>Dr. Chipso Mutongi, Marry Murambi and Tinashe Muchiru</i>	
PERSON-ENVIRONMENT FIT- A PROACTIVE APPROACH FOR OCCUPATIONAL STRESS IN BANKING SECTOR	173 – 176
<i>Rinakhanum and Prof. R. Hiremani Naik</i>	
A SYSTEMATIC REVIEW TO STUDY THE BARRIERS LEADING TO GENDER DISPARITY AT TOP LEVEL MANAGEMENT IN CORPORATE SECTOR IN DELHI NCR	177 – 185
<i>Ms. Srishti Bathla and Dr. Pragati Chauhan</i>	
MICROBIAL PRODUCTION OF BIOPOLYMER: A REVIEW	186 – 192
<i>Punniavan Sakthiselvan, S. S Meenambiga, P. Vivek, H. Sowmya and S. Ivo Romauld</i>	
VACCINATION: AN APPROACH TO END PANDEMIC	193 - 197
<i>Rajakumari K and Yashi Asthana</i>	
PREFERENCES OF EMPLOYEES FOR INDOOR PLANTS IN OFFICE INTERIORS	198 - 201
<i>Dr. Pooja Arya, Ms. Rutu Modi and Ms. Monika Pedgaokar</i>	

A STUDY ON THE EFFECT OF YOGA TRAINING ON BREATH HOLD CAPACITY

Prof. Brij Bhushan Singh¹ and Shubi Mirja²¹Professor, Department of Physical Education, AMU, Aligarh²Research Scholar, Department of Physical Education, AMU, Aligarh**ABSTRACT**

AIM: The purpose of the present study was to investigate the effect of yoga training program on Breath Hold Capacity. Selection of Subjects: Total 15 female subjects who were studying in Tikaram degree college, Aligarh, were randomly selected for this study. Their age ranged in between 18-25 years. Selection of Variables: Breath Hold Capacity of female students were selected for this study. Hypothesis: It was hypothesised that there would be significant effect of yoga training on the Breath Hold Capacity of the female students. Statistic: For analysis of the data Mean & SD were calculated and to examine the effect of yoga training program on the chosen variable. Paired test was applied, and level of confidence was set at .05 level. Results: Significant differences were observed in the means of yoga training group. Conclusion: It was concluded that yoga Training showed significant change in the Breath Hold Capacity of female participants.

Keynotes: Yoga, Breath Hold Capacity, female students

INTRODUCTION

Modern age is the age of science, the progress mankind has achieved through the last quarter of a century. Technology has permeated every aspect of modern life and sports are no exception. Science applied to sports has enabled modern youth to develop physical capabilities beyond any thing imagined earlier. "Competition is one of the out growths of modern life. It is a natural human activity which is evitable in life and the education process should assist in the preparation of individual for the battle of life" progress and a high degree of achievement are the true reflexes of the wonderful world of competition. Nothing could have been higher faster and farther if there had been no competition in sport.

In recent days, most people worldwide are practicing yoga regularly to get and stay fit and healthy. Yoga is a learning method that aims to attain the unity of mind, body, and spirit through these three main Yoga structures: Exercise, Breathing, and Meditation. Training to yoga respiration selectively increases the respiratory sensation, perhaps through its persistent conditioning of the breathing pattern. Perhaps one of the most potent tools in yogic practices is using the breath to bring our consciousness back in tune with the Divine Cosmic Breath. Yoga Asanas have a strengthening and toning impact on the muscular system of the human body. Yoga asanas effectively counteract fitness problems as yoga postures improve physical health and mental peace and aids in spiritual growth.

OBJECTIVE

The purpose of the present study was to investigate the effect of three months of yoga training on the Breath Hold Capacity of female participants.

METHODOLOGY

For the purpose this study fifteen (N=15) female students were selected randomly from Tikaram degree College, Aligarh. U.P. India. Their age was between 18 to 25 years. These subjects participated voluntarily in this programme and before the start, all of them were examined by the physician to ascertain that they were free from any medical problem and were fit enough to undertake the yoga training programme for a period of three months.

HYPOTHESIS

It was hypothesised that there would be significant effect of yoga training on Breath Hold Capacity of the female students.

COLLECTION OF DATA AND ADMINISTRATION OF TESTS

In order to acquaint the subjects with the specific purpose of the research being conducted, all the subjects were assembled in the playground of Tikaram degree college, Aligarh, All the necessary information pertaining to the requirement of the experimental procedure was imparted to them. To make the research findings more authentic, positive attitude towards investigation was emphasized. The data on Breath Hold Capacity were taken before and after the experimental programme at resting condition.

YOGIC EXERCISE METHOD

The training session consisted of 60 minutes every day, for 6 days a week for three months. The yogic exercise was of standing asana, sitting asana, asana in lying position both (Supine & Proline) pranayama, kriyas and meditation with the gradually increased frequency and duration from its initial to final stage.

COLLECTION OF DATA

Breath holding capacity

To measure the positive breath hold capacity the subjects were instructed to place the nose clip tightly. They were asked to inhale through the mouth to the maximum capacity. As soon as the subjects took a deep breath to the fullest capacity of their lungs and close the lips, the stopwatch was started. As soon as the subject opens their lips to inhale, the stopwatch was stopped. The time given by the watch was recorded as the score of the positive breath holding capacity.

Statistical Procedure

For analysis of the data, Mean and SD were computed. The data was analysed using SPSS version 21. Paired t-test was applied to find the significant difference between pre and post experimental means. For testing the hypothesis, the level of confidence was set at .05 level of significance.

DATA ANALYSIS

Table – 1 Significance of difference between Pre and Post Test Performance of Breath Hold Capacity

Group	Test	Mean	SD	SE Mean	DM	SE Mean Diff.	“t” ratio
Yoga	Pre test	24.80	7.81	2.01	6.60	.645	10.21*
	Post test	31.40	9.47	2.44			

*Significant at 0.05 level

$$t_{.05}(14) = 2.042$$

Table-1 reveals the descriptive analysis of yoga training group on Breath Hold Capacity. In this the yoga group pre test shows value of mean and standard deviation (24.80 ± 7.81) respectively. The yoga group post test shows value of mean and standard deviation (31.40 ± 9.47) respectively.

It is evident from Table-1 that there was a significant difference between the means of pre and post test in Breath Hold Capacity of yoga group. The mean difference was calculated as 6.60 and standard error of difference was .645 since the obtained value of paired 't' (10.21) was higher than the tabulated value of 't' (2.042) which was required to be significant at (14) degree of freedom with 0.05 level of confidence.

The graphical representation of mean and standard deviation of pre and post test performance of training group in Breath Hold Capacity has been presented in figure 1.

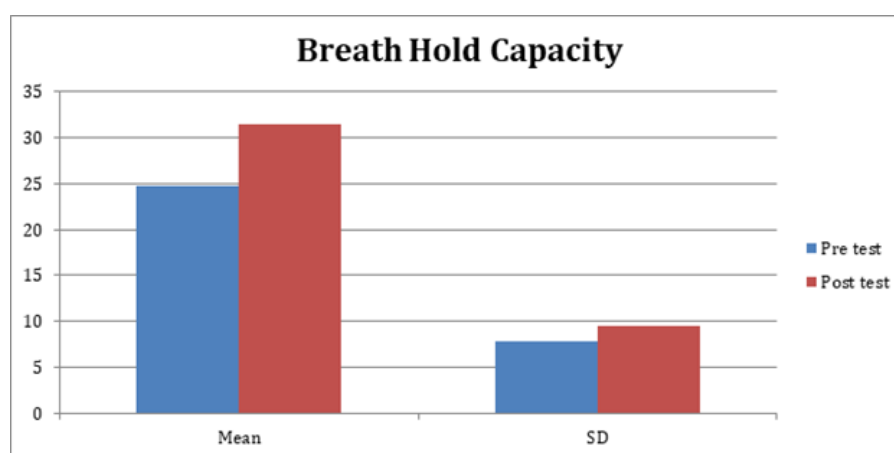


Fig.1

Figure 1-Comparison of mean and SD scores of pre and post- test of yoga training group in Breath Hold Capacity

DISCUSSION OF FINDINGS

The analyses of data showed significant difference in pre and post experimental mean value of Breathe hold capacity of yogic group. Breathe Hold Capacity value of yoga group is significantly increased. The observed results may be attributed to relaxation and the autonomic balance attained through the practice, which is indicated in earlier studies on yoga breathings. (Rajesh Kumar Sinha and Geetanjali 2020) conducted a Cross

sectional study to know the impact of short breathing exercise on breath holding time among 45 subjects of age between 18 -40 years breath holding time was measured before exercise and after short term practice of deep breathing exercise. Results showed that Breath holding time was increased in maximum subjects. They concluded that regular practice of yoga /breathing exercise can be useful in increasing the ventilatory functions.

CONCLUSION

In case of breath hold capacity, subject showed a significant difference between pre and post test in yoga group..

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**ORDERING COST REDUCTION DEPENDENT ON LEAD TIME IN A CONSTRAINED
PROBABILISTIC BACKORDERS INVENTORY MODEL****S. Hemalatha¹ and K. Annadurai²**¹Research Scholar, Mother Teresa Women's University, Kodaikanal – 624101, Assistant Professor,
Department of Mathematics, SSM Institute of Engineering and Technology, Dindigul – 624002.²Assistant Professor, Department of Mathematics, M.V. Muthiah Government Arts College for Women,
Dindigul - 624001**ABSTRACT**

This paper will suggest improving the total cost by reducing holding cost that can mitigate damages to their business during this volatile event. The main contribution of this study is that the probabilistic backorders inventory model with varying order cost, when the lead time demand follows uniform distribution is analyzed by adopting two different (linear and logarithmic) types of ordering cost reductions act dependent on lead time. Our objective is to minimize the expected total cost under a restriction on the expected annual holding cost. In both cases, we develop effective solution procedures for finding the optimal solution and then illustrative numerical examples are given to validate the model. The solution procedure is to determine the optimal solutions of order quantity and the reorder point which minimize the annual total cost. Ordering cost reduction is the main aspect of the proposed model. The mathematical model is solved analytically by minimizing the annual total cost. Finally, the graphical representation is presented to illustrate the proposed model.

Keywords: Uniform distribution, ordering cost reduction, linear, logarithmic, safety stock.

1 INTRODUCTION

Inventory control is the supervision of supply, storage and accessibility of items in order to ensure an adequate supply without excessive oversupply. It can also be referred as internal control of an accounting procedure or system considered to promote good organization. In financial area, the inventory control problem, which plan to reduce overhead cost without hurting sales. In the field of loss anticipation, systems designed to introduce technical barriers to shoplifting. Demand of commodity may be deterministic or probabilistic accordingly inventory models may be either deterministic or probabilistic respectively.

In order to control inventories properly, one has to consider all cost components that are linked with the inventories. There are few such cost essentials, which do affect cost of inventory. One among the cost is the ordering cost. Ordering cost is the cost of ordering raw materials for production purposes. These include cost of placing a purchase order, costs of check-up of received batches, certification costs, etc. Annadurai and Uthayakumar (2010) developed an ordering cost reduction in probabilistic inventory model with controllable lead time and a service level. Annadurai and Uthayakumar (2014) proposed an ordering cost reduction in inventory model with defective items and backorder price discount. In the production environment, lead time plays an important role: which is defined as the time between that elapses between the placing of an order and actually receiving the goods ordered. Chang et al. (2006) deliberated an integrated vendor-buyer co-operative inventory models with controllable lead time and ordering cost reduction. El-Wakeel (2012) considered the backorders inventory model with varying order cost, a restriction on the expected annual holding cost and the lead-time demand follows uniformly distribution. Fergany and El-Saadani (2005) designed a constrained probabilistic inventory model with continuous distributions and varying holding cost. Fergany and El-Wakeel (2006) proposed a constrained probabilistic lost sales inventory system with continuous distributions and varying order cost. Hala and Mona (2006) constrained probabilistic lost sales inventory system with normal distribution and varying order cost. El-Wakeel and Fergany (2013) constrained probabilistic continuous review inventory system with mixture shortage and stochastic lead time demand. Patel et al. (2016) developed a continuous review inventory model under fuzzy environment without backorder for deteriorating items. Vijayashree and Uthayakumar (2016) developed an inventory models involving lead time crashing cost as an exponential function. Tharani and Uthayakumar (2020) explored a novel approach to safety stock management in an integrated supply chain with controllable lead time and ordering cost reduction using present value. Vijayashree and Uthayakumar (2017) proposed a single-vendor and a single-buyer integrated inventory model with ordering cost reduction dependent on lead time. Zhang et al. (2007) developed an integrated vendor-managed inventory model for a two-echelon system with ordering cost reduction. Das Roy (2019) presented an integrated supply chain model with setup cost reduction, exponential lead time crashing cost, rework and uncertain demand.

2 NOTATION AND ASSUMPTIONS

The following notations and assumptions are adopted for developing our model, which are almost similar to those used in the paper by El-Wakeel (2012).

2.1 NOTATIONS

A_c	Ordering cost per cycle
B_c	Backordering cost per unit backorder per cycle
H_s	Holding cost per year
$A_c Q^\gamma$	Varying order cost per cycle, γ is a real number
\bar{D}	Average demand per year
R_0	Reorder point
$E(R_0 - x)$	Safety stock
\bar{H}	Average units of on hand inventory ($\bar{H} = \frac{Q}{2} + R_0 - E(x)$)
M	Limitation on the expected annual holding cost
L_t	Lead time
n	Number of cycles
N	Inventory cycle
Q	Order quantity per cycle
x	Continuous random variable denotes the units demanded during L_t
$f(x)$	Probability density function of the lead time demand x
$R_0 - x$	Random variable represents the net inventory
$p(x > R_0)$	Probability of shortage ($\int_{R_0}^{\infty} f(x)dx = P(R_0)$)
$\bar{B}(R_0)$	Expected number of backorders per cycle ($\int_{R_0}^{\infty} (x - R_0) f(x)dx$)

2.2 ASSUMPTIONS

1. Reorder point R_0 is positive.
2. Demand is a random variable with known probability.
3. An order quantity Q is placed when the on-hand inventory reaches the reorder point R_0 .
4. During each cycle, the system repeats itself when the inventory position varies between R_0 and $R_0 + Q$.

3 MATHEMATICAL MODEL:

The expected annual total cost, which is the sum of ordering cost, holding cost and backorder cost is expressed by using the expected value of a random variable and (El-Wakeel [10]) is given by

$$E(ATC) = E(OC) + E(HC) + E(BC), \tag{1}$$

where $E(OC) = A_c \bar{D} Q^{\gamma-1}$, (2)

$$E(HC) = H_c \left(\frac{Q}{2} + R_0 - E(x) \right) \tag{3}$$

and $E(BC) = B_c n B(r) = \frac{B_c \bar{D}}{Q} \int_{R_0}^{\infty} (x - R_0) f(x) dx$. (4)

Thus, $E(ATC(Q, R_0)) = A_c \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - E(x) \right) + \frac{B_c \bar{D}}{Q} \int_{R_0}^{\infty} (x - R_0) f(x) dx$. (5)

The main aspect is to minimize the expected total cost $E(ATC(Q, R_0))$ under the following constraint:

$$H_c \left(\frac{Q}{2} + R_0 - E(x) \right) \leq M . \tag{6}$$

To solve this primal function, let us write it in the following form:

$$E(ATC(Q, R_0)) = A_c \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - E(x) \right) + \frac{B_c \bar{D}}{Q} \bar{B}(r) \tag{7}$$

subject to: $H_c \left(\frac{Q}{2} + R_0 - E(x) \right) \leq M$ (8)

The optimal values Q^* and R_0^* which minimize Equation (7) under the constraint (8) is obtained by considering the Lagrangian multiplier technique as follows:

$$L(Q, R_0, \lambda) = A_c \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - E(x) \right) + \frac{B_c \bar{D}}{Q} \bar{B}(r) + \lambda \left(H_c \left(\frac{Q}{2} + R_0 - E(x) \right) - M \right), \tag{9}$$

where λ is the Lagrangian multiplier. The optimal values Q^* and R_0^* are obtained by equating the corresponding first order partial derivatives of Equation (9) to zero at $Q = Q^*$ and $R_0 = R_0^*$, respectively, We get

$$Q^{*2} + \frac{2(\gamma-1)A_c \bar{D}}{(1+\lambda)H_c} Q^{*\gamma} - \frac{2B_c \bar{D}}{(1+\lambda)H_c} \bar{B}(R_0) = 0 \tag{10}$$

and $P(R_0^*) = \frac{(1+\lambda)H_c}{B_c \bar{D}} Q^*$. (11)

It's cleared that, finding an exact solution of Q^* and R_0^* is difficult. To get an exact solution, assume that lead-time demand follows the uniform distribution.

4 THE UNIFORM MODEL:

To get an exact solution, assume that lead-time demand follows the uniform distribution (El-Wakeel (2012)) as follows:

Let $f(x) = \frac{1}{a}$; $0 \leq x \leq a$, with $E(x) = \frac{a}{2}$, $P(R_0) = 1 - \frac{R_0}{a}$ and $B(r) = \frac{R_0^2}{2a} + \frac{a}{2} - R_0$. (12)

Then, expected total cost $E(ATC(Q, R_0))$ becomes

$$E(ATC(Q, R_0)) = A_c \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) + \frac{B_c \bar{D}}{Q} \left(\frac{R_0^2}{2a} - R_0 + \frac{a}{2} \right) \tag{13}$$

$$\text{subject to: } H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) \leq M. \tag{14}$$

To compute the optimal values Q^* and R_0^* which minimize Equation (13) under the constraint (14), we use the Lagrangian multiplier as follows:

$$L(Q, R_0, \lambda) = A_c \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) + \frac{B_c \bar{D}}{Q} \left(\frac{R_0^2}{2a} - R_0 + \frac{a}{2} \right) + \lambda \left(H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) - M \right). \tag{15}$$

The optimal values Q^* and R_0^* are obtained by equating the corresponding first order partial derivatives of Equation (15) with respect to Q and R_0 to zero as follows:

$$(1 + \lambda) H_c a Q^{*2} + 2(\gamma - 1) A_c \bar{D} a Q^{*\gamma} - B_c \bar{D} (R_0 - a)^2 = 0 \tag{16}$$

$$\text{and } R_0^* = a \left(1 - \frac{(1 + \lambda) H_c}{B_c \bar{D}} Q^* \right). \tag{17}$$

Solving Equations (16) and (17) simultaneously, we get

$$Q^* = \left(\frac{2(1 - \gamma) B_c A_c \bar{D}^2}{(1 + \lambda) H_c (B_c \bar{D} - (1 + \lambda) a H_c)} \right)^{\frac{1}{2 - \gamma}}. \tag{18}$$

Now Equations (17) and (18) gives the optimal values Q^* and R_0^* respectively. The procedure is to vary λ in Equations (17) and (18) until the smallest positive value of λ is found such that the constraint holds for the different values of γ . Specifically, we consider the cases that the relationships between ordering cost and time is linear function and logarithmic function in two sub sections.

5 SOLUTION PROCEDURE:

5.1 LINEAR FUNCTION CASE:

In this subsection, we assume that lead time and ordering cost reductions act dependently with the following relationship (Chen et al. (2001)).

$$\left(\frac{L_{t_0} - L_t}{L_{t_0}} \right) = \omega \left(\frac{A_{c_0} - A_c}{A_{c_0}} \right) \tag{19}$$

where $\omega > 0$ is a constant scaling parameter to describe the linear relationship between percentages of reduction in lead time and ordering cost. By considering relationship Equation (19), the ordering cost A_c can be written as a linear function of L_t , that is,

$$A_c(L_t) = x + yL_t \tag{20}$$

where $x = \left(1 - \frac{1}{\omega} \right) A_{c_0}$ and $y = \frac{A_{c_0}}{\omega L_{t_0}}$. Substituting Equation (20) in Equation (13), we get

$$E(ATC(Q, R_0)) = (x + yL_t) \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) + \frac{B_c \bar{D}}{Q} \left(\frac{R_0^2}{2a} - R_0 + \frac{a}{2} \right). \tag{21}$$

$$\text{Subject to: } H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) \leq M . \tag{22}$$

To compute the optimal values Q^* and R_0^* which minimize Equation (21) under the constraint (22), we use the Lagrangian multiplier as follows:

$$L(Q, R_0, \lambda) = (x + yL_t) \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) + \frac{B_c \bar{D}}{Q} \left(\frac{R_0^2}{2a} - R_0 + \frac{a}{2} \right) + \lambda \left(H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) - M \right). \tag{23}$$

The optimal values Q^* and R_0^* are obtained by equating the corresponding first order partial derivatives of Equation (23) with respect to Q and R_0 to zero as follows:

$$(1 + \lambda) H_c a Q^{*2} + 2(\gamma - 1)(x + yL_t) \bar{D} a Q^{*\gamma} - B_c \bar{D} (R_0 - a)^2 = 0 \tag{24}$$

$$\text{and } R_0^* = a \left(1 - \frac{(1 + \lambda) H_c}{B_c \bar{D}} Q^* \right). \tag{25}$$

Solving Equations (24) and (25) simultaneously, we get

$$Q^* = \left(\frac{2(1 - \gamma) B_c (x + yL_t) \bar{D}^2}{(1 + \lambda) H_c (B_c \bar{D} - (1 + \lambda) a H_c)} \right)^{\frac{1}{2 - \gamma}} . \tag{26}$$

Now Equations (25) and (26) gives the optimal values Q^* and R_0^* respectively. The procedure is to vary λ in Equations (25) and (26) until the smallest positive value of λ is found such that the constraint holds for the different values of γ .

5.2 LOGARITHMIC FUNCTION CASE:

In this subsection, we assume that lead time and ordering cost reductions act dependently with the following relationship (Chen et al. (2001)).

$$\left(\frac{A_{C_0} - A_C}{A_{C_0}} \right) = \tau \ln \left(\frac{L_t}{L_{t_0}} \right) \tag{27}$$

where $\tau < 0$ is a constant scaling parameter to describe the logarithmic relationship between percentages of reduction in lead time and ordering cost. By considering relationship Equation (27), the ordering cost A_C can be written as a logarithmic function of L_t , and is given by,

$$A_C(L_t) = a + b \ln L_t \tag{28}$$

where $a = A_{C_0} + \tau A_{C_0} \ln L_{t_0}$ and $b = -\tau A_{C_0}$. Substituting Equation (28) in Equation (13), we get

$$E(ATC(Q, R_0)) = (a + b \ln L_t) \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) + \frac{B_c \bar{D}}{Q} \left(\frac{R_0^2}{2a} - R_0 + \frac{a}{2} \right). \tag{29}$$

$$\text{Subject to: } H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) \leq M . \tag{30}$$

To compute the optimal values Q^* and R_0^* which minimize Equation (24) under the constraint (25), we use the Lagrangian multiplier as follows:

$$L(Q, R_0, \lambda) = (a + b \ln L_t) \bar{D} Q^{\gamma-1} + H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) + \frac{B_c \bar{D}}{Q} \left(\frac{R_0^2}{2a} - R_0 + \frac{a}{2} \right) + \lambda \left(H_c \left(\frac{Q}{2} + R_0 - \frac{a}{2} \right) - M \right) \tag{31}$$

The optimal values Q^* and R_0^* are obtained by equating the corresponding first order partial derivatives of Equation (29) with respect to Q and R_0 to zero as follows:

$$(1 + \lambda) H_c a Q^{*2} + 2(\gamma - 1)(a + b \ln L_t) \bar{D} a Q^{*\gamma} - B_c \bar{D} (R_0 - a)^2 = 0 \tag{32}$$

$$\text{and } R_0^* = a \left(1 - \frac{(1 + \lambda) H_c}{B_c \bar{D}} Q^* \right) \tag{33}$$

Solving Equations (27) and (28) simultaneously, we get

$$Q^* = \left(\frac{2(1 - \gamma) B_c (a + b \ln L_t) \bar{D}^2}{(1 + \lambda) H_c (B_c D - (1 + \lambda) a H_c)} \right)^{\frac{1}{2-\gamma}} \tag{34}$$

Now Equations (33) and (34) gives the optimal values Q^* and R_0^* respectively. The procedure is to vary λ in Equations (33) and (34) until the smallest positive value of λ is found such that the constraint holds for the different values of γ .

6 NUMERICAL ANALYSIS

In this section, numerical example is given to validate our model. We follow the data used in the paper by El-Wakeel (2012): $D = 100$ units/ year, $A_c = \$40$ per order, $H_c = \$4$ per year, $B_c = \$7$ per backorder and $a = 20$. The inventory is controlled using a $\langle Q, r \rangle$ system under the constraint that the average holding cost which is summarized in Table 9.

Table.1The expected minimum total cost for Q^* and r^* at all different values of γ (Linear case)

$\omega=5.00$		$A_c(L_t) = x + yL_t$, where $x = \left(1 - \frac{1}{\omega}\right) A_{c_0}$ and $y = \frac{A_{c_0}}{\omega L_0}$. $L_0 = 8$ and $L_t = 8$										
γ	B_c	H_s	A_c	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	40	0	100	20	47.5191	14.5692	84.1767	113.315	10.8615	208.353
0.1	7	4	40	0.09	100	20	52.9680	13.4017	112.318	119.543	14.3843	246.245
0.2	7	4	40	0.302	100	20	56.9200	11.5303	157.706	119.961	22.0551	299.722
0.3	7	4	40	0.54	100	20	61.6328	9.1526	223.456	119.876	33.4099	376.742
0.4	7	4	40	0.789	100	20	67.4050	6.2186	319.775	119.684	49.31	488.769
0.5	7	4	40	1.025	100	20	74.4607	2.7677	463.55	119.992	69.791	653.333
0.6	7	4	40	1.246	100	20	82.1577	-1.0887	685.805	119.961	94.7305	900.496
0.7	7	4	40	1.414	100	20	89.2209	-4.6148	1039.73	119.983	118.84	1278.551
0.8	7	4	40	1.464	100	20	91.5611	-5.7836	1620.76	119.988	127.062	1867.806
0.9	7	4	40	1.167	100	20	79.2261	0.3791	2583.29	119.969	85.0371	2788.296

Example 1 (Linear case) We consider the case that the relationship between lead time and ordering cost is linear. We solve the case when $\omega = 5.00$. Applying the above solution procedure, the computational results for the Linear function case are presented in Table 1 to Table 4. A graphical representation of the expected ordering cost $E(OC)$ and the expected total cost $E(TC)$ against γ is shown in the Figure 1 and Figure 2.

Example 2 (Logarithmic case) We consider the case that the relationship between lead time and ordering cost is logarithmic. We solve the case when $\tau = 0.5$. Applying the above solution procedure, the computational results for the Linear function case are presented in Table 5 to Table 8. A graphical representation of the

expected ordering cost $E(OC)$ and the expected total cost $E(TC)$ against γ is shown in the Figure 3 and Figure 4.

Table 2. The expected minimum total cost for Q^* and r^* at all different values of γ (Linear case)

$\omega=5.00$		$A_C(L_t) = x + yL_t$, where $x = \left(1 - \frac{1}{\omega}\right)A_{C_0}$ and $y = \frac{A_{C_0}}{\omega L_{t_0}}$. $L_{t_0}=8$ and $L_t=6$										
γ	B_C	H_s	A_C	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	38	0	100	20	46.3159	14.7068	82.0453	111.459	10.5865	204.091
0.1	7	4	38	0.09	100	20	51.5571	13.5775	109.326	117.424	14.0012	240.751
0.2	7	4	38	0.302	100	20	55.3209	11.7682	153.275	117.715	21.4355	292.426
0.3	7	4	38	0.54	100	20	59.8009	9.4750	216.814	117.502	32.4169	366.733
0.4	7	4	38	0.789	100	20	65.2784	6.6534	309.686	117.17	47.7542	474.611
0.5	7	4	38	1.025	100	20	71.9575	3.3470	447.966	117.303	67.4448	632.714
0.6	7	4	38	1.246	100	20	79.2021	-0.3300	661.133	117.084	91.3226	869.540
0.7	7	4	38	1.414	100	20	85.7692	-3.6625	999.503	116.888	114.242	1230.634
0.8	7	4	38	1.464	100	20	87.7298	-4.7047	1552.94	116.641	121.745	1791.324
0.9	7	4	38	1.167	100	20	75.6166	1.2730	2465.6	116.325	81.1628	2663.084

Table.3 The expected minimum total cost for Q^* and r^* at all different values of γ (Linear case)

$\omega=5.00$		$A_C(L_t) = x + yL_t$, where $x = \left(1 - \frac{1}{\omega}\right)A_{C_0}$ and $y = \frac{A_{C_0}}{\omega L_{t_0}}$. $L_{t_0}=8$ and $L_t=4$										
γ	B_C	H_s	A_C	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	36	0	100	20	45.0806	14.8479	79.857	109.553	10.3041	199.714
0.1	7	4	36	0.09	100	20	50.1107	13.7576	106.259	115.252	13.6083	235.119
0.2	7	4	36	0.302	100	20	53.6839	12.0118	148.74	115.415	20.8012	284.956
0.3	7	4	36	0.54	100	20	57.9289	9.8045	210.027	115.076	31.4021	356.505
0.4	7	4	36	0.789	100	20	63.1093	7.0968	299.396	114.606	46.1675	460.170
0.5	7	4	36	1.025	100	20	69.4100	3.9365	432.107	114.566	65.057	611.730
0.6	7	4	36	1.246	100	20	76.2017	0.4401	636.087	114.164	87.863	838.114
0.7	7	4	36	1.414	100	20	82.2752	-2.6985	958.786	113.756	109.589	1182.131
0.8	7	4	36	1.464	100	20	83.8648	-3.6163	1484.52	113.264	116.381	1714.167
0.9	7	4	36	1.167	100	20	71.9898	2.1712	2347.34	112.664	77.2699	2537.271

Table 4. The expected minimum total cost for Q^* and r^* at all different values of γ (Linear case)

$\omega=5.00$		$A_C(L_t) = x + yL_t$, where $x = \left(1 - \frac{1}{\omega}\right)A_{C_0}$ and $y = \frac{A_{C_0}}{\omega L_{t_0}}$. $L_{t_0}=8$ and $L_t=3$										
γ	B_C	H_s	A_C	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	35	0	100	20	44.4500	14.9200	78.7401	108.58	10.16	197.480
0.1	7	4	35	0.09	100	20	49.3732	13.8495	104.695	114.144	13.4081	232.247
0.2	7	4	35	0.302	100	20	52.8503	12.1359	146.43	114.244	20.4782	281.152
0.3	7	4	35	0.54	100	20	56.9769	9.9721	206.575	113.842	30.886	351.304
0.4	7	4	35	0.789	100	20	62.0079	7.3220	294.171	113.304	45.3617	452.837
0.5	7	4	35	1.025	100	20	68.1186	4.2354	424.068	113.179	63.8466	601.093
0.6	7	4	35	1.246	100	20	74.6837	0.8298	623.416	112.686	86.1127	822.215
0.7	7	4	35	1.414	100	20	80.5114	-2.2120	938.233	112.175	107.239	1157.648
0.8	7	4	35	1.464	100	20	81.9189	-3.0684	1450.08	111.564	113.681	1675.323
0.9	7	4	35	1.167	100	20	70.1695	2.6220	2287.99	110.827	75.3162	2474.128

Table 5. The expected minimum total cost for Q^* and r^* at all different values of γ (Logarithmic case)

$\delta = -0.5$		$A_C(L_t) = a + b \ln L_t$, where $a = A_{C_0} + \tau A_{C_0} \ln L_{t_0}$ and $b = -\tau A_{C_0}$. $\tau = -0.5$, $L_{t_0} = 8$ and $L_t = 8$										
γ	B_C	H_s	A_C	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	40	0	100	20	47.5191	14.5692	84.1767	113.315	10.8615	208.353
0.1	7	4	40	0.09	100	20	52.9680	13.4017	112.318	119.543	14.3843	246.245
0.2	7	4	40	0.302	100	20	56.9200	11.5303	157.706	119.961	22.0551	299.722
0.3	7	4	40	0.54	100	20	61.6328	9.1526	223.456	119.876	33.4099	376.742
0.4	7	4	40	0.789	100	20	67.4050	6.2186	319.775	119.684	49.31	488.769
0.5	7	4	40	1.025	100	20	74.4607	2.7677	463.55	119.992	69.791	653.333
0.6	7	4	40	1.246	100	20	82.1577	-1.0887	685.805	119.961	94.7305	900.496
0.7	7	4	40	1.414	100	20	89.2209	-4.6148	1039.73	119.983	118.84	1278.551
0.8	7	4	40	1.464	100	20	91.5611	-5.7836	1620.76	119.988	127.062	1867.806
0.9	7	4	40	1.167	100	20	79.2261	0.3791	2583.29	119.969	85.0371	2788.296

Table 6. The expected minimum total cost for Q^* and r^* at all different values of γ (Logarithmic case)

$\delta = -0.5$		$A_C(L_t) = a + b \ln L_t$, where $a = A_{C_0} + \tau A_{C_0} \ln L_{t_0}$ and $b = -\tau A_{C_0}$. $\tau = -0.5$, $L_{t_0} = 8$ and $L_t = 6$										
γ	B_C	H_s	A_C	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	34.25	0	100	20	43.9712	14.9747	77.8919	107.841	10.0506	195.784
0.1	7	4	34.25	0.09	100	20	48.8135	13.9192	103.508	113.304	13.2561	230.068
0.2	7	4	34.25	0.302	100	20	52.2181	12.2299	144.678	113.356	20.2332	278.268
0.3	7	4	34.25	0.54	100	20	56.2555	10.0990	203.96	112.907	30.495	347.362
0.4	7	4	34.25	0.789	100	20	61.1741	7.4925	290.215	112.318	44.7518	447.285
0.5	7	4	34.25	1.025	100	20	67.1420	4.4614	417.988	112.13	62.9312	593.049
0.6	7	4	34.25	1.246	100	20	73.5370	1.1241	613.844	111.57	84.7905	810.205
0.7	7	4	34.25	1.414	100	20	79.1810	-1.8449	922.729	110.982	105.467	1139.179
0.8	7	4	34.25	1.464	100	20	80.4534	-2.6557	1424.14	110.284	111.647	1646.068
0.9	7	4	34.25	1.167	100	20	68.8012	2.9609	2243.37	109.446	73.8475	2426.664

Table 7. The expected minimum total cost for Q^* and r^* at all different values of γ (Logarithmic case)

$\delta = -0.5$		$A_C(L_t) = a + b \ln L_t$, where $a = A_{C_0} + \tau A_{C_0} \ln L_{t_0}$ and $b = -\tau A_{C_0}$. $\tau = -0.5$, $L_{t_0} = 8$ and $L_t = 4$										
γ	B_C	H_s	A_C	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	26.14	0	100	20	38.4141	15.6098	68.0479	99.2675	8.78037	176.096
0.1	7	4	26.14	0.09	100	20	42.3423	14.7254	89.786	103.586	11.4987	204.871
0.2	7	4	26.14	0.302	100	20	44.9390	13.3131	124.511	103.13	17.4128	245.054
0.3	7	4	26.14	0.54	100	20	47.9880	11.5541	173.985	102.192	26.0133	302.191
0.4	7	4	26.14	0.789	100	20	51.6679	9.4361	245.117	101.08	37.7975	383.995
0.5	7	4	26.14	1.025	100	20	56.0735	7.0230	349.081	100.239	52.5569	501.877
0.6	7	4	26.14	1.246	100	20	60.6291	4.4374	506.096	99.0077	69.9073	675.011
0.7	7	4	26.14	1.414	100	20	64.3203	2.2549	749.551	97.6604	85.6731	932.884
0.8	7	4	26.14	1.464	100	20	64.2316	1.9124	1136.99	96.1127	89.1358	1322.236
0.9	7	4	26.14	1.167	100	20	53.8158	6.6721	1754.75	94.3201	57.763	1906.830

Table 8. The expected minimum total cost for Q^* and r^* at all different values of γ (Logarithmic case)

$\delta = -0.5$		$A_C(L_t) = a + b \ln L_t$, where $a = A_{C_0} + \tau A_{C_0} \ln L_{t_0}$ and $b = -\tau A_{C_0}$. $\tau = -0.5$, $L_{t_0} = 8$ and $L_t = 3$										
γ	B_C	H_s	A_C	λ	D	a	Q^*	R_0^*	$E(OC)$	$E(HC)$	$E(BC)$	$E(TC)$
0	7	4	20.38	0	100	20	33.9188	16.1236	60.0847	92.3318	7.75286	160.169
0.1	7	4	20.38	0.09	100	20	37.1431	15.3730	78.7614	95.7784	10.0868	184.627
0.2	7	4	20.38	0.302	100	20	39.1352	14.1767	108.43	94.9771	15.1639	218.571
0.3	7	4	20.38	0.54	100	20	41.4518	12.7045	150.288	93.7216	22.4702	266.480

0.4	7	4	20.38	0.789	100	20	44.2239	10.9581	209.802	92.2802	32.3519	334.434
0.5	7	4	20.38	1.025	100	20	47.4996	9.0072	295.705	91.0281	44.5207	431.254
0.6	7	4	20.38	1.246	100	20	50.7535	6.9723	423.66	89.3962	58.5204	571.577
0.7	7	4	20.38	1.414	100	20	53.1121	5.3471	618.937	87.6127	70.744	777.293
0.8	7	4	20.38	1.464	100	20	52.1993	5.3007	923.999	85.6013	72.4382	1082.038
0.9	7	4	20.38	1.167	100	20	42.9176	9.3711	1399.4	83.3198	46.0655	1528.781

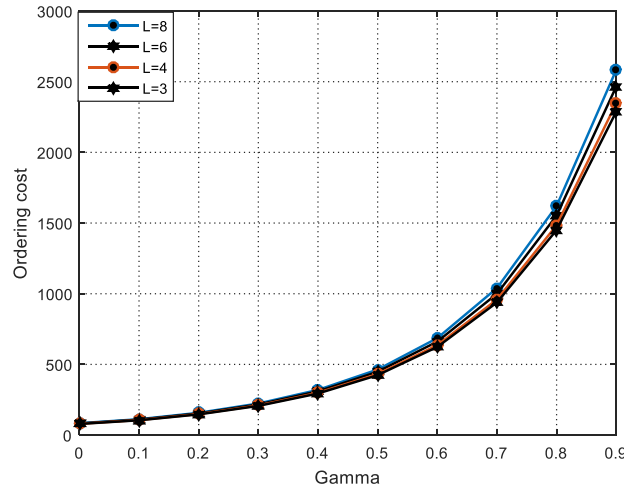


Figure 1. The expected ordering cost $E(OC)$ against γ (Linear case)

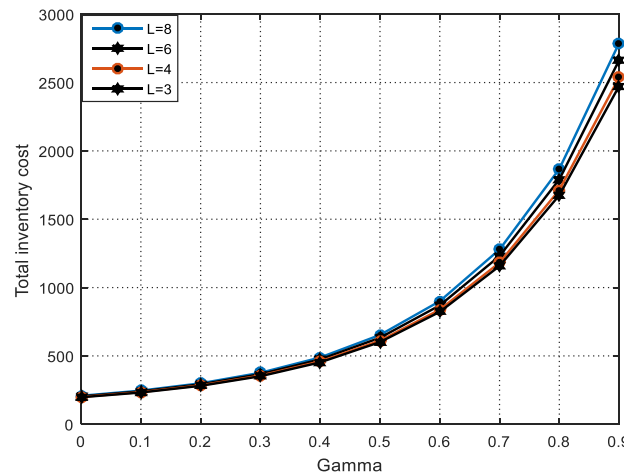


Figure 2. The expected total cost $E(TC)$ against γ (Linear case)

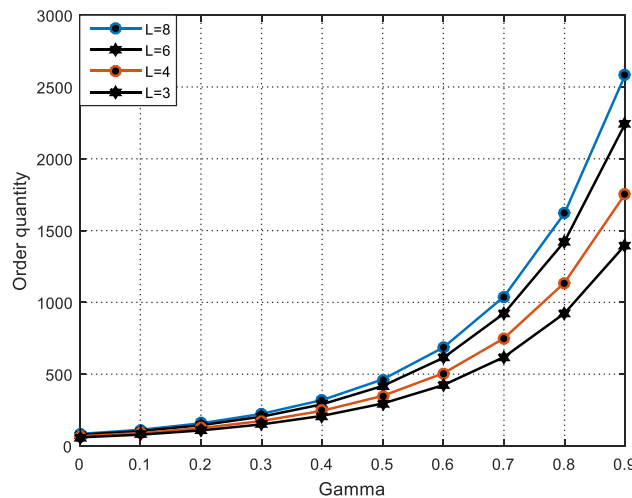


Figure 3. The expected ordering cost $E(OC)$ against γ (Logarithmic case)

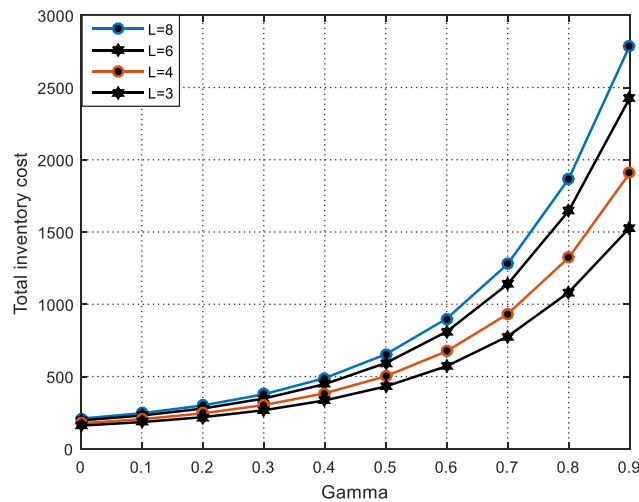


Figure 4. The expected total cost $E(TC)$ against γ (Logarithmic case)

7 CONCLUSIONS

In this study, we discussed two cases of the linear and logarithmic relationships between lead time and ordering cost. In both the cases, we evaluated the exact solutions of Q^* and r^* for different value of γ and this yields our expected holding cost. Also, we obtain the minimum expected total cost by using Lagrangian multiplier technique. To validate our model, a couple of examples are given. The results show that when the reduction of lead time accompanies a decrease of ordering cost, the smaller lot size and larger savings of total expected annual cost can be realized.

Finally, our study in particular provides the sample scope for further research and exploration. This work can be further developed by considering different assumptions and conditions represented in constraints and costs (constant or varying), such as varying two costs under two constraints or varying two costs under constraint or varying one cost under two constraints. Also, we can study some of the inventory models with the system of multi-echelon multisource.

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ENHANCING THE PRODUCTIVITY OF GREEN GRAM THROUGH LAND CONFIGURATION AND NUTRIENT MANAGEMENT IN SODIC SOIL

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ABSTRACT

Field experiment was conducted during kharif season of 2019 at Anbil Dharmalingam Agriculture College and Research Institute, Trichy to find out the effect of different land configuration and nutrient management on green gram under sodic condition. The experiment was laid out in factorial randomized block design with three replication. The land configuration factor consists of the three treatments viz., flat bed, ridges and furrows and broad bed furrow system. The second factor nutrient management comprising of five treatments like 100% RDF + 1% DAP, 100% RDF + 1% MAP, 75% RDF + 2% MAP, 100% RDF + 1% MKP, 75% RDF + 2% MKP. The results revealed that significantly higher pods per plant, number of seeds per plant and yield were recorded under broad bed furrow over farmer's practice of flatbed method. Among the nutrient management with 100% RDF + 1% MKP foliar spray twice at flower initiation and pod formation stage significantly highest growth parameters (pods per plant, number of seeds per plant, 100 seed weight, grain yield and haulm yield) were observed than farmer's practice. Results indicated that broad bed furrow and nutrient management with 100% + 1% MKP has the potential to enhance the productivity green gram under sodic condition

Keywords: Greengram, Land configuration, Nutrient management and Foliar spray

INTRODUCTION

Greengram (*Vigna radiata* L.), is an third important pulse crop after chickpea and red gram. It containing 25 per cent protein which is two to three times more than cereals. In Tamil Nadu, the area under green gram is 1.01 L ha, the production of 0.608 L t and productivity of 605 kg ha⁻¹. It is one of the important short season grain legumes which improve the soil and biodiversity. Poor soil management under sodic soil is one of the major factors responsible for low productivity of green gram. The reason for low yield of green gram under problematic soil are the slow rate of dry matter accumulation, poor pod setting onset of leaf senescence and low partitioning efficiency of assimilates to grain (Pawar and Bhatia, 1980). In addition seed germination is delayed and reduced, seedling emergence and vegetative growth are suppressed under saline and sodic conditions.

Several research workers have notified that land configuration provides better environment for uniform germination, growth, flowering and pod development which eventually increase the yield. Sodic soil having waterlogging problem even for a short period proves detrimental to the crop of green gram particularly during the early growth period to avoid this select suitable land configuration becomes important for successful cultivation of green gram. Raised bed method of sowing has been reported helpful to reduce the effects of temporary water logging and salt injury on plants (Dhimmar, 2003 and Akbar et al., 2007). The raised bed zone of broad bed and furrow system is provide better aerated with lower penetration resistance and proper crop emergence .

Among the crop production technique proper nutrient management is also one of the important factor for sustained production on sodic lands due to their poor fertility status. Sodic soil contain sodium salts which decreases substrate water potential and thus restricts water and nutrient uptake by the roots, high salinity and pH may also cause ionic imbalance and toxicity in plants (Bahadur et al., 2012). Therefore, application of plant nutrients through foliar spray resulted in efficient absorption. Addition of phosphorus nutrient as foliar spray enhances the photosynthetic rate, pod setting, and root development resulted increasing in yield and quality of crop (Deshmukh et al., 2013 and Hossain et al., 2007). Excess application of K as foliar spray reduce accumulation of sodium which reduce stress and ensure the availability of nutrients under the saline and sodic condition (Blumwald, 2000 and Kaya et al., 2001)

MATERIALS AND METHODS

A field experiment was conducted at Department of Agronomy, Anbil Dharmalingam Agriculture College and Research Institute, TNAU, Trichy during kharif season 2019. The soil of the experimental field was sandy clay loam in texture and alkaline in reaction. Fifteen treatment combinations of three levels of land configuration viz., flat bed, ridges and furrows and broad bed furrow system. Five levels of nutrient management namely farmer's practice of 100 % RDF + 2 % DAP, 100 % RDF + 1 % MAP, 75 % RDF + 2 MAP, 100 % RDF + 1 MKP, 75 % RDF + 2 MKP were evaluated in Factorial Randomised Block Design with three replications.

The green gram variety VBN (Gg) 2 was sown on 5th July 2019 as per treatments mentioned above, after onset of monsoon using a certified seed with seed rate of 20 kg ha⁻¹. To prevent the crop from soil and seed borne diseases, the seeds were treated with Thiram and keeping 30 cm inter-row spacing and intra-row spacing of 10 cm was maintaining by thinning operation at 15 DAS. The foliar spray applied twice at flower initiation and followed by 15 days interval. Six irrigation were given to the crop. Recommended cultural practices were also adopted as per need of crop.

The spray solution of DAP, MKP and MAP were prepared by dissolving 10 g and 20 g of fertilizers in one litre of water to get 1% and 2% concentration. MKP and MAP fertilizers are highly water soluble salts which completely dissolved in water but DAP granules were dissolved in little quantity of water and allowed to settle overnight and the supernatant solution was taken for spraying after dilution with remaining quantity of water.

Yield attributes and yield observation

In each treatment and replication, five plants were selected and their respective number of pods, pod length and seeds per plant was recorded. The grains were dried in oven at 105±3°C, for 24 hr and 100 grain weight for each treatment (in three replication) were recorded. The average values was evaluated and expressed in grams. After drying the pod, length (cm) and weight of haulm and seed was taken and expressed as kg ha⁻¹. The yield of grains with plot size 20 m² of each treatment and replication was recorded from the net plot and calculated as kg ha⁻¹.

Statistical Analysis: The data collected were subjected to statistical analysis in ANOVA. Whenever the treatment difference was found significant, critical difference was calculated at 5 percent probability level and the values were furnished. If there are no significant difference between treatments, it was denoted by the symbol NS.

RESULT AND DISCUSSION

Land configuration

Land configuration methods did not influence significantly for 100 seed weight (table). While number of pods per plant, number of seeds per plant and yield was influenced significantly.

Number of pods per plant was significantly higher under broad bed method of sowing as compared to flatbed method of sowing (Table 1). Maximum number of seeds per pod was observed under broad bed furrow method of sowing. This might be due to maintain of proper air moisture regimes under broad bed method of sowing improved soil aeration, available nutrients and better soil environment ultimately resulted in better growth and development of crop which reflected in higher number of pods per plant and number of seeds per pod of green gram in sodic condition. Under broad bed furrow method of sowing influenced to improve the drainage which leads to supply of required moisture because these sodic soil condition are prone to temporary water logging after rainfall and irrigation due to low infiltration rate. The present findings are in agreement with those reported by Rathore et al., (2010), Jadhav et al., (2012) and NICRA, 2014.

Further, higher number of pods per plant under broad bed furrow method of sowing resulted in significantly higher seed yield. Similar trend was also observed for haulm yield of greengram because of higher dry matter accumulation per plant under broad bed furrow method. This might be due to lower salt injury to plants under broad bed method of sowing as plant root had less chance to revelation with soluble salts which improved soil environment, root development, optimum moisture –air equilibrium throughout the crop growth period besides easily supply of available nutrients to greengram reflected in higher seed and haulm yields. The results are in accordance with finding of Kaya et al., (2001), Jat et al., (2012) Joshi et al., (2018) and Yadav et al. (2019).

Nutrient management

Application of 100 % RDF + 1 % MKP observed significantly improved yield attributes and yield over other treatments. Among the nutrient management, application of 100 % RDF + 1 % MKP observed significantly maximum number of pods per plant, seeds per pod and 100 seed weight and it was followed by 100% RDF + 1% MAP as compared to farmer's practice of 100% RDF + 2% DAP. This might be due to the excess application of K as MKP reduce negative effect of sodium salts and also increase uptake of nitrogen which attributed to better growth of plant which resulted in higher production of photosynthates were utilized by plant for development of sink under adequate supply of nutrients through recommended of fertilizer with foliar application phosphorus fertilizer gave higher number of pods per plant, number of seeds per pod and 100 seed weight under sodic condition. These results are in conformity with those of Himani et al., (2017), Gupta et al., (2006), and Bulut et al., (2011)

Similarly, seed yield and haulm yield were also recorded significantly higher with application of 100 % RDF + 1 % MKP over farmer's practice of 100% RDF + 2% DAP. The higher yield under these treatments might be due to cumulative effect of better yield attributes (number of pods per plant, seeds per pod and 100 seed weight) and higher nutrient uptake by green gram under sodic condition. The present findings were in accordance with those of Ganiger et al., (2003), Chandrasekhar and Bangarusamy (2003), Behera and Elamthi (2007), Ghanshyam et al., (2010) and Nawange et al., (2011). Similarly Abdi et al., (2002) and Khan et al., (2006) reported foliar application of potassium significantly increased yield

Economics

Economics is the foremost criteria for the farmers while adopting to new technology. Broad bed furrow method of sowing recorded higher net returns and benefit cost ratio over flatbed method of sowing. Application of 100 % RDF + 1 % MKP recorded higher net returns and benefit cost ratio as compared to other treatments. This mainly due to maximum yield and productivity under these treatments leads to the higher net returns and benefit cost ratio. Similar findings were in close vicinity of Shete et al., (2010) and Choudhary et al., (2013).

In case of interaction effect, there is no significance difference with the land configuration and nutrient management

Treatment	Number of pods/plant	Number of seeds / pod	Tw (g)	Grain yield (q ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Net income (Rs.)	B:C Ratio
Land configuration							
L ₁	20.87	9.99	2.9	5.4	1430.2	12511	1.5
L ₂	29.42	11.19	3.1	7.6	1794.4	23244	1.8
L ₃	31.6	11.97	3.2	8.5	1952.8	29955	2.0
SEd	0.66	0.24	0.14	20.31	63.54	-	-
C.D(P=0.05)	1.34	0.51	NS	41.61	130.16	-	-
Nutrient management							
N ₁	28.26	10.94	3.1	7.3	1721.89	22944	1.8
N ₂	29.27	11.49	3.2	7.9	1912.56	26110	1.9
N ₃	22.87	9.82	2.7	6.0	1438.33	15207	1.6
N ₄	30.26	12.33	3.3	8.0	1996.22	26794	2.1
N ₅	25.83	10.67	2.97	6.5	1560.00	18460	1.7
SEd	0.85	0.31	0.14	26.22	82.03	-	-
C.D(P=0.05)	1.74	0.64	0.28	53.72	168.04	-	-

CONCLUSION

The present study concluded that soil problem with sodic condition are commonly affect pulses productivity, it can be overcome with land configuration and nutrient management. Sodic soil have a major impact on green gram productivity for sustainable farming system and sodification can also extend into subsoil layers posing serious problems for plant root development and remedial action. On the basis of conducted field experiment recommended that broad bed furrow method of sowing with application of 100 % RDF + 1 % MKP, is the better practical way to manage the sodic soil and increase productivity and benefit cost ratio in green gram.

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EFFECT OF 12 WEEKS OF MEDITATION ON HEART RATE VARIABILITY OF COLLEGE GIRLS

Brij Bhushan Singh¹ and Samiya Husain²¹Professor, Department of Physical Education, Aligarh Muslim University, Aligarh- 202002²Research Scholar, Department of Physical Education, Aligarh Muslim University, Aligarh- 202002**ABSTRACT**

Aim: *The purpose of the present study was to investigate the effect of meditation on heart rate variability.*

Selection of Subjects: *Total 60 female subjects, who were studying in Tikaram Degree College, Aligarh, were selected for this study. The subjects were divided into experimental and control group of 30 each. Their age ranged in between 18-25 years.*

Hypothesis: *It was hypothesised that there would be a significant effect of meditation on the Heart Rate variability of the college girls.*

Statistic: *For analysis of the data Mean & SD were calculated and to examine the effect of meditation on the chosen variable. Paired t-test was applied, and level of confidence was set at .05 level.*

Results: *Significant differences were observed in the pre and post experimental mean of high frequency HRV and low frequency HRV of meditation group with insignificant difference seen in the pre and post test mean of high frequency HRV and low frequency HRV of control group.*

Conclusion: *It was concluded that meditation caused significant change in the Heart Rate variability.*

Keynotes: *Meditation, Heart Rate variability, College girls.*

INTRODUCTION

Meditation is a simple mental technique which has well documented benefits for health and wellbeing. It can be learned easily by anyone regardless of age, educational background, or culture. The technique is effortless and requires no belief or any change in lifestyle or diet. During Meditation mental activity settles down in a natural way, while alertness is maintained and even enhanced. Meditation produces a specific physiological response pattern that involves various biological systems. Mechanism most frequently suggested that meditation produces effects including metabolic, autonomic, endocrine, neurological, cardiovascular and psychological responses on a multidimensional interactive basis. Mental states can markedly alter physiologic function. For example, stressful situations result in a hyper metabolic state, with increased oxygen consumption, heart rate and blood pressure. In contrast, the majority of scientific studies show meditation to be a wakeful state accompanied by a decreased metabolism resulting in decreased breathing pattern, decreased heart rate, and decreased blood pressure.

Heartfulness is heart based meditation. It is a simple and practical way to experience the hearts unlimited resources. Through Heartfulness, we are able to really listen to the heart which enables us to master our life in a joyful way. This exercise of fine – tuning the heart with the mind is done through a stepwise scientific approach to meditation. In Heartfulness meditation you sit in a comfortable position, close your eyes and start with a thought that divine light is present in your heart.

In the last decade, research on Heart Rate Variability has increased due to its clinical application of identifying cardiovascular autonomic imbalance during cardiovascular disease pathogenesis (Billman et. al., 2015). With the documented worldwide increase in cardiovascular morbidity and mortality, detection of cardiovascular risk factors earlier in life would help provide timely intervention (Harrell et. al., 1996). Nowadays, cardiovascular diseases and their risk factors are increasingly occurring at a younger age (children and adolescents) (Steinberger et. al., 2003 & Berenson et. al., 1998). Heart Rate Variability testing can play an essential role in detecting cardiovascular autonomic derangement even in children and adolescents. However, to be used clinically, normative data must be established in this age group considering other significant factors that can influence Heart Rate Variability, such as physical activity (Gutin et. al., 2005 & Wood et. al., 1998).

OBJECTIVE

The purpose of the present study was to investigate the effect of twelve weeks of meditation on heart rate variability of college girls.

METHODOLOGY

For the purpose of this study 60 female students were selected from Tikaram Degree College, Aligarh. U.P. India. The subjects were divided into meditation and control groups of 30 students in each group. Their age ranged between 18 to 25 years. These subjects participated voluntarily in this programme and before the start, they were examined by the physician to ascertain that they were free from any medical problem and were fit enough to undertake the meditation training programme for a period of three months.

HYPOTHESIS

It was hypothesised that there would be significant effect of meditation training on Heart Rate variability of the college girls.

TRAINING PROGRAMME

The subjects selected for the present study were divided into two equal groups called experimental group, and Control group, each consisting of 30 female students in the age group of 18 to 25 selected from Tikaram Degree College, Aligarh, for twelve weeks heart based meditation training was given to the experimental group. The time and frequency of meditation training was increased gradually from beginning to the end of the session. The control group was not to allow participating in any of the training program, except their classes. Measurements for the variable were taken at the beginning (pre-test) and at the end of the experimental period of twelve weeks (post-test) the data was collected for the variable from experimental group and control group.

Collection of Data and Administration of Tests

In order to acquaint the subjects with the specific purpose of the research being conducted, all the subjects were assembled in the field of Tikaram Degree College, Aligarh, All the necessary information pertaining to the requirement of the experimental procedure was imparted to them. To make the research findings more authentic, positive attitude towards investigation was emphasized.

The research scholar with the help of the lab technicians had put in maximum effort and meticulous care to attain precision and accuracy in the measurements of the physiological variable. All the subjects were tested in morning session. The subjects were taken to the Department of Physical Education, Aligarh Muslim University, where their HRV was recorded prior to the running of experimental programme for both the groups. Similarly, after the completion of three months of training programmes, all the subjects were once again tested in the morning session for HRV.

The data on Heart rate variability were taken prior to the experimental programme. Pre-test data was collected two days before the commencement of the training program and post-test data was collected after the training procedure.

HEART RATE VARIABILITY

To measure the Heart Rate Variability (Autonomic Functioning) PHYSIO-PAC (PC 2004) Digital Polygraph Software System (Medicaid system, Chandigarh, 160002, India) were used. The subjects were instructed before the test to remain on the couch/bed for 5 minutes, then the leads were connected to their limbs and chest. Two leads electrocardiographic data were recorded for 10 minutes and were downloaded to HRV Software Analyzer. The frequency domain analysis was done by Fast Fourier Transformation. In the frequency domain, we measured low-frequency power (LF) and high-frequency power (HF). The score was recorded LF (ms^2), HF (ms^2).

STATISTICAL PROCEDURE

For analysis of the data, Mean and SD were computed. The data was analysed using SPSS version 21. Paired t-test was applied to find the significant difference between pre and post experimental means. For testing the hypothesis the level of confidence was set at .05 level of significance.

DATA ANALYSIS

Table-2t test
Combine Table of HRV High Frequency

Groups	Test	Mean	SD	SE Mean	DM	SE Mean Diff.	"t" ratio	Sig.
Meditation	Pre test	25.7133	10.83225	1.97769	10.91667	2.54819	4.284*	.000
	Post test	36.6300	10.84188	1.97945				
Control	Pre test	69.6080	9.64616	1.76114	1.67533	3.19336	.525	.604
	Post test	71.2833	12.45195	2.27340				

*Significant at 0.05 level $t_{.05}(29) = 2.045$

Since calculated t-value is greater than tabulated t-value thus we conclude that significant difference is existing in the means of pre and post experimental High Frequency (HRV) of **meditation group**.

Insignificant difference is exists in pre and post experimental means of High Frequency (HRV) of Control group as the calculated t-value is lesser than the tabulated t-value.

**Table-2 t test
Low Frequency (HRV)**

Groups	Test	Mean	SD	SE Mean	DM	SE Mean Diff.	“t” ratio	Sig.
Meditation	Pre test	73.9167	8.99303	1.64189	10.59667	1.82867	5.795*	.000
	Post test	63.3200	11.54820	2.10840				
Control	Pre test	69.6080	9.64616	1.76114	1.67533	3.19336	.525	.604
	Post test	71.2833	12.45195	2.27340				

***Significant at 0.05 level**

$$t_{.05} (29) = 2.045$$

Since calculated t-value is greater than tabulated t-value thus we conclude that significant difference is existing between the means of pre and post experimental Low Frequency HRV of meditation group.

Insignificant difference exists in pre and post experimental means of low Frequency (HRV) of Control group as the calculated t-value is lesser than the tabulated t-value.

DISCUSSION OF FINDINGS

The analysis of data reveals significant difference in pre and post experimental means of **high frequency (HRV) and low frequency (HRV)** of meditation group with insignificant difference in pre and post experimental means of **high frequency (HRV) and low frequency (HRV)** values of control group. **Rezende Barbosa, M. P., et al., (2015)** discovered that 12 weeks of periodized functional training was able to produce improvements in autonomic modulation (heart rate variability) of women. **Weippert, M., et al., (2015)** in their study found that physical load was effective in order to improve parameters of traditional HRV indices SDNN, RMSSD, ln LFP, and ln HFP. **Sandercock, G. R., et al., (2005)** reported in their meta analysis that exercise training results in significant increase in High Frequency (HF) power and RR interval. Thus we thus conclude that LF and HF of HRV values are certainly influenced by meditation training.

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EXPLORING THE RELATIONSHIP OF SERVICE QUALITY WITH MODERATING IMPACT ON A GENDER. A STUDY OF FIVE-STAR HOTELS RESTAURANTS IN DELHI-NCR.

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ABSTRACT

Customers' assessments of service quality are crucial for service organizations' survival in today's highly competitive business environment. While several studies have examined the connection among service quality and customer gratification in restaurants of Delhi-NCR Five-Star hotels, very few have examined the moderating impact of gender. Customer satisfaction is found to have a considerable association with the quality's tangibles, certainty, and empathy. However, there is only a little correlation between these three qualities and dependability and responsiveness. Empathy and customer satisfaction are significantly associated. While there is a minor positive correlation between openness and customer satisfaction, these findings suggest that in order to maximize customer satisfaction, Five-Star Hotel restaurant management should improve the quality of their services, particularly in terms of responsiveness. Additionally, gender influences the quality of a service and the degree of client satisfaction.

Keywords: Service Quality, Delhi-NCR, Customer Satisfaction, Gender, Restaurants

I. INTRODUCTION

Restaurant service quality has experienced significant adjustment and development. Restaurants provide physical demands, but they must now also meet social and self-realization needs, boosting service quality standards and requiring restaurant management to address service quality, perceived value, and customer pleasure in order to retain customers. In an increasingly competitive market, they must retain existing consumers while also acquiring new ones. The issue of quality in the workplace has been the subject of extensive investigation. Industry of service [1]–[3].

Customers' opinions on service quality are crucial for service providers who wish to increase their core competencies, position their companies more strategically, and perform better in the market [4], [5]. Service providers are constantly looking for ways to get a competitive advantage by delivering better service [6]. Service quality, according to [7], is commonly described as the customer's assessment of the service's overall excellence or superiority. To evaluate the five elements of service quality—reliability, responsiveness, empathy, assurance, and tangibles—the SERVQUAL technique was created. [1] While claiming that interactions between clients and service providers have an impact on how well service standards are perceived in Five-Star hotel restaurants. Customer satisfaction is thought to influence redemption intents and behaviour, which primes to future revenue and profitability for a company. Service superiority and customer happiness have developed a concern for all organisations, as well as the eatery industry, as a result of their direct link to earnings. In order to attract clients, additional businesses are being forced to assess and enhance their level of customer service [9].

Customer pleasure, on the other hand, is one of the most basic constructs used to explain the process of developing customer loyalty [10]–[13]. Similarly, a study of the literature on customer happiness and loyalty reveals that customer satisfaction has a positive impact on customer loyalty [14]–[16]. Client happiness is vital because it serves as the foundation for building a successful customer association, retaining and intensifying new clients, and collecting customer lifetime value. A satisfied customer will make additional purchases, inform others about the product's benefits, and show little regard for similar products supplied by competitors. [17].

This study is important for understanding what factors contribute to consumer satisfaction and how gender affects the connection amid service excellence and patron satisfaction in Five-star hotel restaurants. A few research [7], [11], [13], [18], [19] have examined the link between positive client experiences and the caliber of eatery services. However, none of the studies mention five-star dining. This study's objective is to examine the connection between service quality and customer satisfaction in Five-Star hotel restaurants in Delhi-NCR, to see which attribute has the most impression on patron fulfilment, and to see if gender has a moderating effect on service excellence and customer fulfilment in Delhi-NCR Five-Star Hotel restaurants.

2 REVIEW OF LITERATURE**2.1. Customer Satisfaction**

Satisfaction, according to [20] a conclusion that a feature of a product or service provides a satisfying equal of eating related. Customers' satisfaction, according to [21], is defined as their statement that the quality of the

meal or service was at least acceptable. Since it reflects the varying opinions of the client base about the product, customer satisfaction is essential. related to the consumption experience distinctive performance [4]. In terms of customers, Positive word of mouth can be used to gauge loyalty, as well as revisiting the intention and willingness to return. [3], [21] were used to compile this list (2006). According to [7], perceived value is a substantial influence in customer purchasing verdicts, implying that behavioral intentions are a result of perceived value. Customers are more likely to indicate good behavioral intentions when they experience high degrees of value through consumption. Customers are more likely to share their opinions by recommending the same experience to others if they value their experiences in terms of their difficulty or utilitarianism. When patrons perceive the value of the dining experience to be high in terms of its cognitive and emotive components, they are more inclined to recommend a restaurant to others..

2.2 Service Quality:

According to [4], service quality is defined as a company's capacity to meet the demands and desires of its customers. Service quality was defined by [8] as a function of the disparities between expectations and performance along the quality dimensions.

[22]defined service as a mindset that indicates a long-term commitment.

According to [23], quality service exists where the hotel's personnel work provides a service that they are proud of and prepared to stand by. Furthermore, the Customer needs must be handled instantly, and service must be supplied on schedule suitable.

The degree of mismatch between customers' normative expectations for the service and their views of service performance is described as service quality [24]–[26] Because of its apparent relationship to customer happiness, service quality has become a hot topic, according to [27] According to [28], service quality is a cognitive judgement based on particular criteria.

The term "service" has been defined in a variety of ways in the literature on service excellence. Services, for example, are defined by [27] as "those separately identifiable, fundamentally intangible activities that give want satisfaction and are not necessarily related to the sale of a product or another service." Services are defined by [15] as the "intangible (untouchable or inconsumable) part of the dining out experience." Given that eating in eateries is chiefly a common affair, [3]claimed that service is a critical or basic factor in the restaurant industry.

2.3. Service Quality Characteristics

The tool that is most frequently used to gauge perceived service quality in marketing literature is SERVQUAL. It has five components: tangibles (physical facilities, equipment, and human appearance), reliability (ability to consistently provide the promised service), flexibility, and adaptability (ability to adapt to changing circumstances). and specificallyresponsiveness (willingness to help customers and offer prompt service), assurance, and (understanding of the product or service). Customers receive the company's undivided attention. Empathy (personalised, caring) & civility (including employee politeness, as well as their ability to inspire trust and confidence).

Services are intangibleThe authors claim that this is due to the fact that customers have trouble imagining them in addition to the fact that they cannot see, touch, feel, hear, or taste them. Services are difficult to visualise, define, and convey due to their intangibility. [15]Therefore, what a restaurant meant to give may be very different from what patrons actually get. [11]

Additionally, clients find it challenging to evaluate or understand the specific nature of the services supplied due to the intangibility of services. [29]. Clients or guests are acutely mindful of the existence or lack of services, notwithstanding their intangibility [20]. Customers, for instance, are quick to notice whether a waiter or waitress is unfriendly or uninterested in them. [27].

Tangibles: Services are challenging to illustrate, describe, and communicate due to their intangibility. Because of this, what a restaurant meant to serve may be very different from what consumers actually get,the physical look of the establishment's facilities, equipment, and people Restaurants employ tangibles to communicate their image and indicate quality to customers as a result. The authors contend that the intangibility of services stems not just from the fact that customers cannot see, touch, feel, hear, or taste them but also from the difficulty in imagining them. Services are challenging to illustrate, describe, and communicate due to their intangibility

Reliability: refers to a business's capacity to provide consistent and correct service. In its largest meaning, reliability refers to an establishment's ability to follow through on its promises, such as those regarding service provision, pricing, delivery, and problem resolution [14], [18], [30]In restaurants, reliability can be characterised as meeting customer demands for menu item preparation, table reservations, and accurate billing,

among other things. The goal of service providers is to give clients fast service and assistance. When responding to client enquiries, requests, difficulties, and complaints, this dimension stresses attention to detail and promptness. The amount of time a customer has waited for assistance, answers to enquiries, or attention to issues may reflect a company's responsiveness. That is, if staff members properly respond to a customer's request for prompt service, or if consumers are quickly assisted with the wine list and menu, responsiveness can improve the quality of services given. [7].

Assurance: Employee expertise and civility, as well as their capacity to express self-assurance and confidence, are all aspects of assurance. When customers are unsure about a restaurant's service options, this dimension becomes critical [7]. Patrons may feel more secure if they can rely on the waiter's advice., are pleased that the meal is free of uncleanness, and may express any concerns deprived of fear of being insulted or retaliated against. Empathy is the helpful and adapted kindness that a business gives to its clients, such as giving them as persons. Through personalized service, the essence of empathy is conveying to clients that they are valuable and unique. [7]. Patrons need to awareness valued and understood by the businesses that offer them with facilities. Personnel in eateries can demonstrate empathy by greeting guests by appellation, learning about their eating needs and favorites, and being empathetic and sensitive to their issues[1].

Behavioural Intentions

Behavioral intentions are the degree to which an individual intends to perform or not perform a given activity in the near future [31]. According to [17], positive word-of-mouth, more spending with the service provider, paying a price premium, and remaining loyal are examples of favourable behavioural intentions, whereas unfavourable behavioural intentions include leaving the service provider, less spending with the company, and negative word-of-mouth. [32] divide behavioural intents into two categories: revisit and word-of-mouth. As a result, the building of an attitude toward the provider based on previous experiences with a product or service leads to consumer intent to repurchase and suggest consumers. As a result, behavioural intention is addressed in this study in the form of future restaurant visits, recommendations, and good word-of-mouth communications.

2.4 Atmospheric Quality: Customers cannot be satisfied solely by improving food quality, according to [1], [4], for example, claimed that parameters related to cleanliness had a considerable impact on restaurant quality assessment, while The importance of total ambience perception was emphasized by [33]. In the case of Njite et al. Ambience has a beneficial impact on consumer intentions in premium dining. Patronage and willingness-to-pay tend to grow significantly when the environment is improved. Customers' emotional responses are most strongly influenced, by the music, aroma, temperature, and employee appearance, which all have an impact on the environment Intentions of restaurant patrons in terms of conduct.

Among researchers and hospitality managers, the phenomenon to create an appealing and healthy physical environment has attracted growing attention as it is a vital component for attracting and pleasing customers in the hospitality business[1], [8], [34], [35] Intentions of restaurant patrons in terms of conduct.

2.4. Moderating Variable

Self-determining variable that influence the way and/or degree of the link between independent and dependent variables are known as moderating variables. Customer characteristics are defined by [9], [19], [27] as the form of demographic information like age, gender, and socioeconomic position. Customers' differences in gender, age, and income are crucial factors that affect their pleasure. [4], [21], [27], [32], [36]. Gender, mentions to a set of features that differentiates men from women. Gender identity plays a substantial role, according to empirical investigations undertaken by [14], [27].

Men are more likely to take risks than women, according to social role theory, because men are socially predictable to involve in hazardous behavior [4], [5]. Men who follow internalized gender characters might be fewer inclined to remain devoted once their fulfilment heights alter because switching providers and trying something new is riskier. Women, on the other hand, are predicted to react differently to variations in satisfaction levels.

3.1 Hypothesis Formulation: The researcher identified independent variables based on the literature tangibles such as dependability, receptivity, assurance, and empathy, as well as one moderating factor, gender. Customer pleasure is the dependent variable. A framework was used to construct one hypothesis. The SERVQUAL instrument, developed by[27], is the foundation of the research framework. Based on [37], expectancy confirmation theory, this method measures customer expectations and perceptions, resulting in increased customer satisfaction.

H1 Gender will significantly alter the relationship between service quality and customer happiness.

3.2 METHODOLOGY

The persistence of this learning is to gain a better understanding of analyzing the moderating effect of patron gender in the restaurants of five-star hotels in Delhi NCR, Additionally, the strength of each service quality attribute's relationship with perceived customer happiness was determined. To investigate the elements of service quality and customer satisfaction, a quantitative study was conducted, and a number of questionnaires were created. A poll that obtained 386 replies was used to collect the data. Correlation analysis and hierarchical regressions were used to evaluate quantitative data. According to the correlation study, each of the five service quality characteristics tangibles, dependability, responsiveness, assurance, and empathy has a favourable relationship with customer satisfaction.

4.1 Demographic Profile

The gender distribution of respondents was diverse according to the demographic profile, with 28.8 percent female and 71.2% male respondents. The respondents' most common age group is 18-28 years old (37.5 percent), followed by 28-38 years old (28.2 percent), 20 years old and under (23.2 percent), and 38-48 years old (9.2 percent). Government employees account for the bulk of respondents (35.3%), followed by sheltered sector (37.2%), pupils (31.5%), and independent 7%. Only 3.7 percent of respondents dined more than six times per month, followed by 19 percent who dined three to five times per month, and the bulk who dined one to two times per month.

4.2 Customer satisfaction and the relationship between service quality attributes

Table 1. The link between customer happiness and service quality attributes.

Attributes	Pearson Correlation	Sig. (2-tailed)	n
tangibles	.676**	.000	386
reliability	.663**	.000	386
responsiveness	.647**	.000	386
assurance	.683**	.000	386
empathy	.685**	.000	386

** At the 0.01 level, the correlation is significant (2-tailed).

Table demonstrates a significant, two-tailed, significant correlation between each independent variable tangibles, reliability, responsiveness, assurance, and empathy and the dependent variable customer satisfaction at 0.01 levels. The findings also revealed that all independent factors and customer satisfaction have favorable associations. Customer happiness is worth 0.676, reliability is worth 0.663, responsiveness is worth 0.647, assurance is worth 0.689, and empathy is worth 0.685. All the variables have the same statistical significance. Assurance ($r=0.683$), empathy ($r=0.685$), tangibles (0.676), and reliability ($r=0.663$) have the strongest positive link with customer happiness. Responsiveness ($r=0.647$) is the lowest indicator with a positive link with customer satisfaction.

4.3 Multiple regression analysis with a hierarchical structure:

Table 2. Hierarchical multiple regression

Model	B	SE B	β	t	Sig.
(Constant)	13.067	2.177			
Tangible	.551	.144	.236	3.752	.000
Reliability	.154	.150	.077	1.035	.302
Responsiveness	.062	.141	.033	.441	.660
Assurance	.447	.168	.197	2.664	.008
Empathy	.880	.183	.288	4.845	.000
Gender	-2.170	.755	-.095	-2.788	.007

(Note: $R^2 = .57$, $*p < .001$)

There were only four significant characteristics: tangibles (sig. value = 0.05), assurance (sig. value = 0.05), empathy (sig. value = 0.05), and gender (sig. value = 0.05). Dependability and responsiveness, however, were judged to be unimportant (sig. value = 0.380 > 0.05) and inconsequential (sig. value = 0.441 > 0.05). Which variables are significant in the model are shown by the biggest value of the beta coefficient. How to forecast customer happiness is shown in Table 2. In the model, assurance ($\beta = .197$, $p = 0.01$), tangibles ($\beta = .236$, $p = 0.01$), and empathy ($\beta = .288$, $p = 0.01$) are the three most important predictors.

On the other hand, reliability and responsiveness are eliminated ($\beta = .077$, $p = 0.05$) and ($\beta = .033$, $p = 0.05$), respectively. Confirmatory factor regression analysis was employed to determine whether a control variable (gender) could predict satisfaction levels after accounting for service quality. To ensure that the assumptions of normalcy, linearity, multicollinearity, and homoscedasticity had not been broken, preliminary investigations were conducted. In step one, service quality was responsible for 5.6 percent of the difference in customer gratification. The overall variation explained by the model was 56.8% after incorporating the Gender at Step 2, $F(6,404) = 88.36$, $p = .001$. After accounting for tangibles, dependability, responsiveness, assurance, and empathy, the control measure still only explained a further 0.8 percent of the variance in customer satisfaction (R^2 change = .008, F change (1, 404) = 7.78, $p = .001$). The gender had a beta value of $-.095$, $p = .001$, in the concluding model, indicating that the control measure was statistically very significant.

5 DISCUSSION

According to the results, gender significantly influenced how strongly the association between service quality and customer happiness. [8], [17], [19], [32], [36]. male clients, according to studies, show a higher level of interest than female customers. Customers who are male have a higher level of satisfaction than customers who are female [1], [4], [19], [27], [32]. When evaluating service encounters, male clients are more goal-oriented, according to [11]. Female clients, on the other hand, are more socially oriented. Furthermore, male customers are more likely to have greater service quality expectations.

This may be since female clients are more interested in social concerns, have stronger connection needs, and desire to forge peaceful connections with others. [16]. Female consumers give better performance ratings and are more sensitive to relationship components of a service encounter [8] as a result of these distinctions. As a result, they paid more attention to the services of staff than male clients [36]. As a result, restaurant owners should make greater efforts in the future to boost male client happiness.

The conclusions of this survey will assist restaurant owners in determining the level of client satisfaction. This research also identifies the restaurant owners' strengths and flaws, which they must preserve and enhance in their services. Customers are also satisfied with the eatery's level of empathy, tangibles, and certainty, according to the data. As a result, to maximize client happiness, restaurant owners must ensure that these three criteria are effectively maintained and developed. The study also discovered that restaurant owners fall short of their consumers' expectations in terms of dependability and responsiveness. This demonstrates that restaurant owners must focus more on providing regular and dependable services, as well as providing clients with accurate bills.

6 CONCLUSION

Since reliability, responsiveness, certainty, and empathy are all observable qualities, this study finds a substantial correlation between them and customer happiness. Additionally, it was demonstrated that gender had an impact on the association between customer happiness and service quality. This study relies on convenience sampling, which means that it did not target respondents and had a strict cap of 386 respondents. As a result, different sampling techniques could be utilized to gather the data in future investigations. The researcher had special needs because the data was supposed to be collected from Five-Star hotel restaurant patrons, which brings us to our final point. This study is centered on Five-Star Hotel restaurants in Delhi-NCR. As a result, it is advised that studies in the future concentrate on eateries in the lower-end category.

7 LIMITATIONS AND FUTURE SCOPE OF THE STUDY

The results and insights from this study are thought to be more applicable to restaurants in Five-Star hotels, therefore some restrictions may present an opportunity for further research. This study provides evidence for the association amongst service quality and gender-moderating effects.

As a result, it's probable that the results would be different in other sorts of restaurants, such as fast service restaurants with a variety of food options and services. In relation to socially embedded phenomena, research shows that customer expectations vary among different types of restaurants. Therefore, it could be important to expand the study's variables beyond a Five-Star hotel restaurant setting to see if the same characteristics hold true.

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INDIAN TRIBAL FOLK ARTS AND ITS SIGNIFICANCE**Apurva Narendra Thosar**

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ABSTRACT

India has always been famous for its tradition and culture through art and craft. 35 state and union territories spread across the Indian land and having their own beliefs, identities, and display through various art forms. There are total 645 district tribes in India. The tribal folk art of India expresses simplicity, colorful design, and motifs. People identify any tribe through their art and culture. Major tribes and tribal art of the India are the Gond, Mandana art of Madhya Pradesh, Madhubani art of Bihar, Kalmkari of Andhra Pradesh, Warli art of Maharashtra, Pichhawi of Rajasthan, Pithro of Gujarat and many more. This paper examines and evaluates the current existing tribal art to analyze and looks at the current state of tribal art, as well as its replenishment and expansion. All of these arts are working to reclaim its popularity by utilizing diverse management visions and missions, as well as other variable analysis. All these art are moving towards an end to bring back their popularity by using various vision and mission of management and their factors.

Keywords- Tribal Art, Replenishment, Expansion, Culture, Community, Vision-Mission, Life cycle

INTRODUCTION

Indian belongs to Indigenous communities which known as “Tribes or Adivasis”. Adivasis nomenclature used for many Indigenous societies of India also reflects as scheduled Tribe. Many legal and constitutional terms create dissimilar from state to state and from one area to another. The total populations of Indian tribes according to 2011 census are 8.10% of total Indian population (90 million). (1) Indian tribes are formation of the Indian civilization also known as society organizers. These tribes are famous for their rich culture, tradition, art forms, dance, language and music. Nature plays a big role in tribal culture. Most of the tribes are depends on forest. Folk and tribal art overlap each other. Tribal art can be folk art but folk arts belong to non tribal community. Both arts belong to different community and have different vision and mission. Through their tribal art and folk art they show their life cycle, living style. Every art form is different from other according to community. Tribal people work as individual artist, in small scale group and large scale group as per the condition. Today the situations of these arts are depleting somewhere. Artesian not getting proper platform for their art because of this problem tribal art lacking their value and its own significances. In the primary study of different evolutionary phases of the tribal art should be observed. Suggestion is also creating to safeguards and documents this priceless attempt for the further study.

Warli Art of Maharashtra

Warli tribe is the biggest tribe found in northern skirts of Mumbai in western ghat India in century of AD in the Neolithic period of 2,500 BC and 3000BC. The word Warli is derived from “Waral” which means a small patch of cultivated land that means an uplander. Warli art is known for its combination of geometric shapes, circles, triangles, and lines. Warli art is made on mud wall and cow dung wall. Warli paintings do not depict any mythological characters. It only depicts social life, human figures engaged in doing activities. (1)



Fig.1 Warli art (1)

Gond Art of Madhya Pradesh

Gond tribes are the largest tribe of Madhya Pradesh or central India. The word “Gond” is derived from the Dravidian “Kond” which means Green Mountain. Gond tribe generated 1400 years ago. Gond tribes generally made gond art to paint their homes, mud wall, floor during festivals. Motifs used in Gond painting are animals, plants, human, birds, with the combination of dots and dashes. (2)



Fig .2 Gond arts (2)

Mandana Art of Madhya Pradesh and Rajasthan

Mandana art forms are famous in the regions of Madhya Pradesh and Rajasthan in area of Bundi and Alwar area. Mandana word is derived from Mandan which means ornamentation or decoration. In Madhya Pradesh Mandana art is made on floors only but in Rajasthan it’s made on floors as well as walls.(3)



Fig.3 Mandana art (3)

Kalamkari Art of Andhra Pradesh

Kalamkari art is the tribal art of Andhra Pradesh. Kalamkari The name is derived from the Persian words Kalam (pen) and Kari (craftsmanship). Machilipatnam is the area in Andhra Pradesh where kalamkari is mostly made. There are different types of Kalamkari made, one of them is Srikalahasti style and another one is Machaipatnam style. Kalamkari arts are fabric art, Mahabharata, Ramayana stories are derived on cloth. (1)



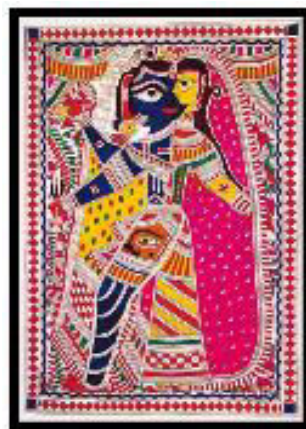
Fig.4 Kalamkari art (1)

Pahad Art of Rajasthan

Rajasthan is well known for pahad painting. It's an art which is done on a long fabric Called "pahad". In bhilwara district phad painting founded. It's a type of scroll painting. Phad were discovered by scholars of Rajasthan in 60's. Phad painting has deities of Rajasthan, Pabuji and Devnarayan. Phads are painted with natural vegetable colors. (5)

**Fig.5** Pad painting (5)**Madhubani Art of Bihar**

Madhubani is one of the finest arts of India. Madhubani art belongs to Mithila region of Madhuban in Bihar. Madhubani art is also known as Mithila art. It is believed that this art form was originated from Ramayana. These arts are made on handmade paper and clothes. During festivals and marriage ceremonies Madhubani paintings are drawn. Madhubani paintings depict the nature, humans, animals, Gods and deities, some geometric shapes, birth of Lord Krishna, Ram-Sita marriage.(6)

**Fig.6** Madhubani art**Saora Art of Orissa**

Saora art belongs to Saora tribes which are present in hilly area of South Orissa. Saora art Shows daily life of the Saora tribes. The motifs used in art are human, sun, moon, hosts, tutelary spirits. The Saora artist used right angle triangle to make the anthropometric world to show different emotions and mood through art. (1)

**Fig.7** Saora art (1)

Pithora Art of Gujarat

Pithora art had very long history roots of thousand year back. Rathura community made this art. In this art seven horses represent seven hills surrounded by rectangular fence. This art give the message of peace. The main motives used in paintings are horse and bull which give the vision of God. Pithora has very colorful appearance.

(1)



Fig.8 Pithora Art (1)

Wood Carving Art of Uttar Pradesh

Uttar Pradesh state is well known for many folk-arts one of the folk arts is wood carving. Saharanpur district is famous for this art. This talent of wood carving art has been passed by generation to generation. Carving is done on ebony wood, walnut wood with flower motives, Jali, vine leaf pattern. (7)



Fig.9 wood carving (7)

Lacquer Wooden Toys Art of Karnataka

Handmade lacquer wooden toys are the tribal art of Channapatna. Its belongs to a rural area 60km away from Bangalore. This place is famous as Gombegala or Toy Town of Karnataka all over the world. These toys were originated during the period of Tipu sultan. He was known as a toy collector. Ivory wood, Rose wood, Sandalwood are used to make the wooden toys. (8)



Fig.10 Showing Lacquer wooden toys (8)

Phulkari Art of Punjab

Punjab state is well known for its folk art Phulkari. It's a thread work on fabric. Phulkari means flower work. The full heavy work of Phulkari is known as "Bagh". Bagh means "garden". Phulkari dupattas are famous all over the punjab. Phulkari was originated from Iran in 15th century. In Iran Phulkari is known as "Gulkare. (9)



Fig.11 Pulkari art (9)

Thangka Art of Tibet and Northen Himalayas

Thangka word belongs to Tibetan word which means 'Recorded message'. Thangka art forms are religious art forms. Thangka art comes from Buddhist philosophy. Thangka paintings are used in temples and monasteries. Thangka paintings are also known as scroll paintings. This art communicates a message from the painting. It also shows the Buddhist spiritual path (10)



Fig. 12 Thangka art (10)

Kachchi Embroidery Art of Gujarat

Kachchi embroideries art are famous all over the nation. Kachchi name was originated from the place Kutch. Embroideries are known for fine needle work. Mochis Rabari, Mutwa, Ahir community of Gujarat worked for this embroidery from the time of Mahabharata. Embroidery is done on silk cotton fabrics by using silk or woollen threads with different patterns. (11)



Fig.13 Kachchi embroidery (11)

Aipan Art of Uttarakhand

Aipan art belongs to kumaoni homes. The Aipan word is derived from “Arpan”. Most common words used for Arpan are “Likhai”. Aipan art is made with fingers. It’s a geometrical, linear and flower art. Women use to make Aipan in front of home, on door step on the occasion of festivals, weddings, worships, births. (12)



Fig. 14 Aipan Art (12)

Patachitras Art of Orissa

Patachitra art was originated from Jagannath temple which is located in puri in 12th century. It’s a one of the oldest art form of Orissa. Patachitra word came from the Sanskrit word “patta” means chitra (picture). It’s a very rich art done on canvas. Creative motifs like human and trees with mythological paintings are made by artists. Natural colours are used in these paintings. (1)



Fig.15 Patachitras art (1)

Chamba Rumal Art of Himachal Pradesh

Himachal Pradesh is known for Chamba Rumal folk art. It’s a handmade Embroidery art done with colourful thread of the hand spun cotton cloth of square shape which is also known as Rumal. Ideas are taken from Pahari paintings to weave the Rumals. This craft was started in 17-18 century AD in Himachal Pradesh. Natural motifs like Birds, flowers, leaves, stories of gods are made on Rumal. Chamba rumals are available in many sizes. (13)



Fig. 16 Chamba rumal (13)

Tanjore Art of Tamil Nadu

Tanjore paintings are folk art of Tamil Nadu which is famous all over the nation. Tanjore arts are made by the two main communities of TamilNadu Rajus and Naidus. Tanjore art was found in 16th century. In these paintings various Hindu gods appears with almond shaped eyes gilded and gem set technique is used to make god leafs, sparkling stones, ornaments, woods, are used to make paintings. Tanjore paintings are made on cloths like curtains and woods like photo frames. (14)



Fig.17 Tanjore Art (14)

Loin Loom Weaving Art of Nagaland

Loin loom weaving is one of the tribal arts of Nagaland which belongs to Angami tribes. Loin loom is also referred as a back strap or body tension loom known as oldest devices for weaving cloths. It's very easy to use and is mostly made of bamboo. It's portable. Shawls, bags etc are made from this. Mostly woven cloths are used for this. Red, white, blue, black are mostly used. It consists of parallel lines with geometric patterns. (15)

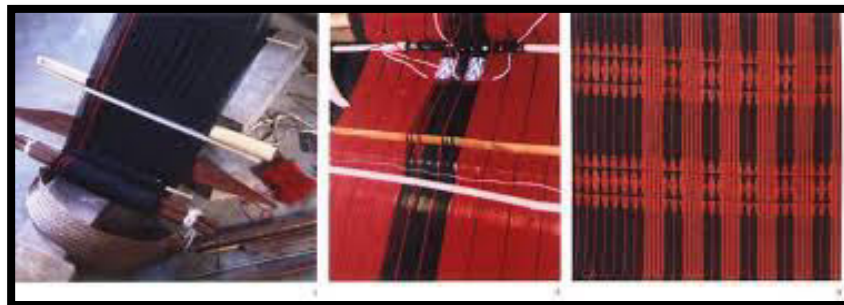


Fig.18 Loin loom art (15)

Iron Art of Chhattisgarh

Iron art is the tribal art of Chhattisgarh. Lohars community of "kondagoan" which belong to Bastar. People living here are always engaged in this work. This art is also known as hammer art. Artists make iron art by hammering on iron and give the shape as they want. It's a hollow iron art and only front part has specific crafts. (16)

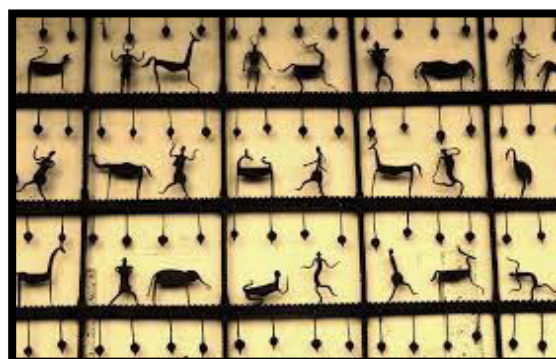


Fig.19 Iron art (16)

LITERATURE REVIEW

Chattopadhyay (1978): This paper focused on the term tribe as the Latin word. Tribes as a social group. Specific area, with specific tradition and culture. They called as Adivasies in India Hindi language. for the machine made crafts which are cheaper too instead of going for the hand-made handicrafts which involve hard work and long time. Eventually the tribal arts and crafts are prone to (5).

Krishnan (1985): Explained that Tribes is an indigenous homogeneous unit living in a particular geographic area like forest, hills and naturally isolated areas speaking a common language. Having a technology backload. India had second largest tribal population country in the world. South India described as home of pre historic man (5).

Mishra (2007): This paper describes that Tribal society lives close with biodiversity rich landscapes with their specific and novel livelihood tradition and culture. This knowledge of tribal society Passes from one generation to another generation which play the important role towards the conservation and sustainable use of biodiversity .They are totally depend on nature for their survival, so there always organic unity between human and there surrounding environments in the tribal societies(5)

Sanyal (2007): This study explains how to detect variations in expand from 1991 to 2006 and how to show that exports have been declining owing to changes in global demand and market competitiveness. (5)

Thaimani (2012): A study found that a lack of market understanding is the most significant impediment to any rural business attempting to join the urban market. (6)

Significances of Tribal Folk Arts

Indian tribal folk arts are integral part of Indian tradition, culture and heritage. They had their own significant rule towards their art forms. All these tribes are dependent upon their art form for economical growth which makes up a significant part of the economy's decentralized sector.

Tribal Artisans Encounter a Variety of Concerns

The artisans are confronted with a number of issues. Artists are unable to obtain appropriate platforms for their work. One of the major issues that artists encounter is that they do not have adequate certainty of regular sales from orders, trades, and clients. Artists and consumers are unable to interact effectively due to a lack of proper communication skills. Financial constraints also cause a slew of issues for artists, such as a lack of materials, transportation costs, and so on.

A New Variation to Be Purposed

Tribal arts are on the verge of becoming extinct. They require special attention from society. The government must establish an effective management structure for tribal artists. New categories in the realm of design, such as interior, architecture, and product design, can be formed. Tribal art should be recognized as a distinct subject in all design schools or education board. All of these techniques will assist artists in growing their businesses. The media can provide individuals with all of the information they need regarding tribal art.

CONCLUSION

India is one of the world's oldest civilizations, and it is also recognized for its tribal folk art tradition, culture, and legacy. Throughout Indian culture's history, it has been greatly affected by a variety of art and culture from India's tribal peoples, who have continued their creative work, particularly tribal art. Without tribal folk art in human life, the culture will be incomplete, and occasions will be incomplete. Their art forms are vanishing, causing craftsmen to face numerous challenges. Tribal art can be saved from extinction with the support of society and government, as long as they follow the current changes.

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IMAGE ENCRYPTION BASED VISUAL CRYPTOGRAPHY SCHEME IN SECURED DIGITAL TRANSMISSION SYSTEM

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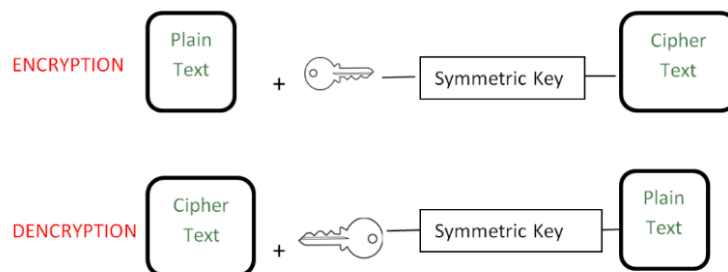
ABSTRACT

In this paper we present a new cryptographic scheme proposed for securing color image based on visual cryptography scheme. A color image to be protected and a binary image used as key to encrypt and decrypt are taken as input. A secret color image which needs to be communicated is decomposed into three monochromatic images based on YCbCr color space. Then these monochromatic images are converted into binary image, and finally the obtained binary images are encrypted using binary key image, called as share-1 to obtain binary cipher images. To encrypt Exclusive OR operation is done between binary key image and three half-tones of secret color image separately. These binary images are combined to obtain share-2. In decryption the shares are decrypted, then the recovered binary images are inverse half-toned and combined to get secret color image.

Keywords: cryptographic scheme, binary cipher images, secret color image.

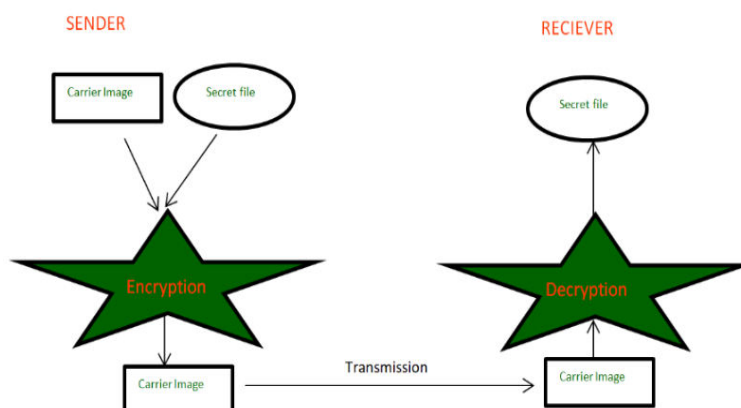
INTRODUCTION

The Internet is the fastest growing communication medium and essential part of the infrastructure, nowadays. To cope with the growth of internet it has become a constant struggle to keep the secrecy of information and when profits are involved, protect the copyright of data. To provide secrecy and copyright of data, many of the steganographic techniques have been developed. But each of the technique has their respective pros and cons. Where one technique lacks in payload capacity, the other lacks in robustness. So, the main emphasis of cryptography is to overcome these shortcomings. The word cryptography is derived from two Greek words which mean “secret writing”. Cryptography is the process of scrambling the original text by rearranging and substituting the original text, arranging it in a seemingly unreadable format for others.



Cryptography is an effective way to protect the information that is transmitting through the network communication path.

Visual cryptography is a cryptographic technique which allows visual information (pictures, text, etc.) to be encrypted in such a way that decryption can be done just by sight reading. Visual cryptography, degree associated rising cryptography technology, uses the characteristics of human vision to rewrite encrypted photos. Visual cryptography provides secured digital transmission that is used just for merely the once.

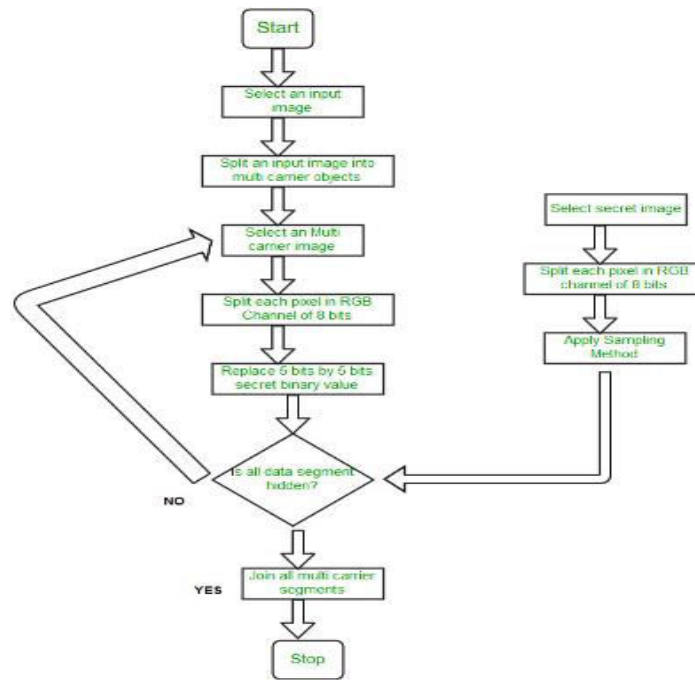


Numerous guidance like military maps and business identifications are transmitted over the internet. Whereas pattern secret photos, security problems ought to be compelled to be taken into thought as a result of hackers may utilize weak link over the communication network to steal info that they need. To touch upon the protection problems with secret photos, varied image secret sharing schemes are developed. anyone will use it for coding with none science information and any computations.

The proposed work is basically a framework design with two modules:

1. Data Hiding using multiple bits replacement scheme and
2. Visual Cryptography using Multi-layer Multi-shares method. An input image is accepted as a cover image for the secret image to be hidden.

1. Data Hiding



Algorithm: Data Hiding

Algorithm Input: Any image.

Output: Other Image Hidden by Input Image.

Step 1: An input carrier image will be selected.

Step 2: An input image gets split into 4 multi carrier objects. One multi carrier image object is selected from all 4 image objects.

Step 3: The Secret image to be hidden get splits into RGB Channels each of 8 bits. Split each pixel in RGB channels of 8 bits each and separate each of 3 colors 8-bit component into 3 bits and 5 bits.

Step 4: As Image comprises of pixel contribution from red, green and blue components, each pixel has numbers from the color components (for 24-bit bitmap image each of red, green and blue pixel has 8 bit). Split each pixel in RGB channel of 8 bits each and separate each of 3 color 8 bit component into 3 bits and 5 bits and then replace 5 bit of color component by 5-bit binary secret value.

Step 5: Our visual system cannot detect changes in pixel and thus it is possible to replace Secret image bits with image pixel bit. Lastly, it will check that whether all data objects are hidden. And all the above steps are repeated for other remaining carrier objects. Finally, by joining all multi-carrier image objects, we get a hidden image.

2. VISUAL CRYPTOGRAPHY

2.1 Proposed Image Encryption Method

Algorithm: Image Encryption.

Input: Hided Image.

Output: Encrypted Image.

Step 1: An input image will be selected. It must be an RGB image.

Step 2: Red, Green and blue Channels are separated from an input Image.

Step 3: Each Channel is then further encrypted into 8 shares. This encryption will depend on key used.

Step 4: From Step 3, we get 24 shares, it means each channel has 8 shares each. These 8 shares of an each channel then further compress to 3 shares. Thus we get an o/p of 9 shares at step 4.

Step 5: Compress 3 Shares from step 4 to one final encrypted image.

Proposed Image Decryption Method

Algorithm: Image Decryption.

Input: Final Encrypted Image.

Output: Decrypted Image.

Step 1: Select an Encrypted Image. It must be RGB Image.

Step 2: Separate Red, Green and Blue Channels from an Encrypted image.

Step 3: Create 3 Shares from each channel. So at step 3, 9 Encrypted images will be the output.

Step 4: Create 8 Channels from Each channel.

Step 5: From 8 shares each of step 4, Create 3 Shares (i.e red, green and Blue each).

Step 6: Compress Step 5 Images to Plain Image (Decrypted Image).

Applications

There are many applications of Visual Cryptography some of them are following:

1. Secret Communication
2. Copyright Protection
3. Document Authentication
4. Secret data storing

One of the common kinds of portrayal is an image. Image is a sight and sound part identified by human understanding. Image information security is a critical assessment course in the field of information security. These days, mystery images are moved over the web for political, clinical, military, social, and for a few significant business purposes. Accordingly, the fundamental objectives for image encryption are information secrecy, information respectability, validation, and non-disavowal. Every communicator needs to guarantee that the genuine recipient's soul ought to get the image with no snooping and intercession from an outsider for each correspondence. Image data security is a significant exploration heading in the field of data security. Data security is the of correspondence networks in light of the fact that; there happens an issue during sharing data . Two major classifications of the cryptographic protocol are symmetric key and asymmetric key protocols suggested Visual secret sharing plot is an engraving method to shroud mystery messages into at least two inane images, known as shares. Multi secret sharing plans are used routinely to share various favored bits of knowledge. The organization coordinator shares numerous mystery images utilizing this basic offer. The calculation charge is the significant downside of such a plan. The double number juggling-based plan uses particular worth choosing capacity while encoding and deciphering mystery images Particular worth choosing capacity improves irregularity property of offers and satisfies limit property. Hence, the proposed strategy gives a computationally productive technique while fulfilling limited security measures. the visual cryptographic plan creates various nonsensical portions of the image with explicit data. All offers of the information bring together to reproduce the mystery data. Generally essential thought of the cryptographic plan related to encipher the images, the images tuck away the mystery into 'm'

image offers. It will be mind-boggling in the direction of programmers to recover the first information about the image. Moreover to build secrecy and security of the first information, utilize the proficient coded message calculation. The new coded message in addition to unscrambling is created utilizing the dispersion strategy with a mix of disorganized guides. By and large, the proposed visual cryptographic scheme is partitioned into three stages they are, scission of shading groups, creation of a few offers, and the third one is coded and decoded data, the shading image is partitioned into three ways are red, green, and blue. Afterward, different portions of data are produced dependent on the pixel sizes. From that point onward, coded and decoding are finished by utilizing

a dissemination cycle related to the turbulent guide. Exploratory consequences of different investigations and PC recreations affirm that the latest calculation offers more safety and is appropriate for pragmatic image encryption presented a session key-reliant image encryption system wherein the session key is the capacity of a unique mystery key and the current mystery image to be scrambled. Moreover, the plan doesn't need extricating and recalling meeting keys to build the ensuing meeting keys despite the fact that the keys variation during every transmission. Furthermore, in this plan, a twofold encryption procedure is needed, which and affirms that the strategy proposes is more strong than the regular image encryption methods known to date and is equipped for opposing digital assaults of such sorts. A cryptographer is consistently looking for plans to develop security and well-being for every correspondence where session key execution is a solid setup thought. In the recommended calculation Session key1 and Session key2 are utilized for double periods of encryption where double keys change in each transmission yet extricating just as recollecting the meeting key isn't crucial for developing the following session key. In this work, it is clear that the soundness of the plan is improved in opposition to any digital assault than traditional image encipher methods for a specific key size.

CONCLUSION

encryption algorithms and settles that Visual Cryptography is an exceptional type of encryption method to unclear mystery data, unscrambled by the Human Visual System. It is vague to uncover the undisclosed data except if a specific amount of parts or additional in the middle of a number of parts are overlaid. The decoding cycle is finished by a human visual framework, mystery data can be recovered by any- body if the individual gets in any event k numeral of parts. For this, direct visual cryptography is very safe. Fractal Graph generating technique gives more prominent key sensitivity, this sort of encryption calculation more protected. Three-dimensional chaotic map strategies have huge key space and great strength against differential and some notable assaults. Feistel structure and various chaotic frameworks give to have a specific anti-jamming capacity.

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SECURE IMAGE ENCRYPTION BASED VISUAL CRYPTOGRAPHY SECRET SHARING IMAGE

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ABSTRACT

Visual cryptography (VC) is one of the best techniques used to secure information. It uses the human vision to decrypt the encrypted images without any cryptographic computations. The basic concept of visual cryptography is splitting the secret image into shares such that when the shares are stacked, the secret image is revealed. In this paper we proposed a method that is based on the concept of visual cryptography for color images and without any pixel expansion which requires less space. The proposed method is used to encrypt halftone color images by generating two shares, random and key shares which are the same size as the secret color image. The two shares are generated based on a private key. At the receiving side, the secret color image is revealed by stacking the two shares and exploiting the human vision system. In this paper, we produce an enhanced form of the proposed method by modifying the encryption technique used to generate the random and the key shares. Experimental results have shown that the proposed and the enhanced methods suggest an efficient way to encrypt a secret color image with better level of security, less storage space, less time of computation and with a better value of PSNR.

Keywords: Visual Cryptography, Image Encryption.

INTRODUCTION

The rapid development in computer technology and the internet and the need to transfer data from one place to another requires finding a way to secure data transmission. Secure methods are needed to guard data against hacking or attacks. An attempt to find a secure method that guarantees data protection has become a challenge for many researchers in this field. Pioneering innovation in securing and encrypting secret data against hacking are Naor and Shamir [1]. In 1994, they proposed a visual cryptography scheme, which can decode concealed images without any complex cryptographic computations. Their basic model was used for black and white images where it generates n transparencies of the original secret image. Stacking only k (or more) of the n transparencies can reveal the original secret image. This model suffers from pixel expansion, where the size of the recovered secret image is not the same as the size of the original one. Many VC techniques have been proposed to recover black and white images and color images [2]. Moreover, several studies employ both cryptography and steganography to provide a high level of security for data transmission the share images and the recovered image is the same as the original secret image. The scheme improved the quality of the share images and the recovered secret image. They first presented a method based on a block-wise approach called simple block replacement (SBR) for preprocessing the halftone image. The method is easy to implement but the resulting secret image is darker than the original image. Therefore, they proposed the balance block replacement (BBR) method in order to keep the local ratio of black to white pixels in the processed image close to the local ratio of the black to white pixels in the original halftone image thus improve the quality of the resulting image. Amin and Lijina in applied dithering to the block replacement method called balance block replacement (BBR) in order to improve the quality of both the shared images and the recovered secret image. In Fersna and Athira proposed an encryption technique without pixel expansion for color images. The technique gradually recovers the secret image. Our proposed method is used to encrypt halftone color images by generating two shares, random and key shares, which are the same size as the secret color image. The two shares are generated based on a private key. At the receiving side, the secret color image is revealed by stacking the two shares and exploiting the human vision system. The proposed method keeps the secret color image with a better level of security and quality as much as possible. Also time and storage space needed are minimized the proposed method suggested a way to encrypt a secret color image based on VC system. The secret color image is encoded into meaningless share images. Individual share images do not give any information about the original secret image. The contents of the secret image can only be revealed by stacking all the share images. The resulted share images are the same size as the original secret image without pixels expansion.

The proposed method involves two stages; encryption and decryption: The Encryption Stage

Step 1: The creation of the halftone image.

The original secret image is half toned into a binary image using a dithering technique.

Step 2: The halftone image is split into three layers Red, Green and Blue (ImgR, ImgB, and ImgG)

Step 3: The generation of one layer of the Random share (the Mask)

The size of the Mask generated is the same as the size of the secret image.

To generate the random share (Mask), a private key, which both the sending and receiving sides know, is used.

We consider the share as a set of rows and columns. The pixels in the even rows take a random value (either 0 or 1). The odd rows are filled with the complement value of the pixels in the even rows directly above it. If the pixel in the even row is black (white) then the pixel in the odd row beneath it will be white (black) The Mask will be used to generate the key share in Step 4.

Step 4: The generation of the key share (share 2)

The Key share is consisted of three layers Red, Green and Blue (called share2R, share2G and share2B). The layers of the key share are constructed using the random share (Mask) and the layers of the half toned image. Each layer of the key share will be constructed as follows:

Each layer of the half toned image is partitioned into non-overlapping blocks of size 2×1 pixels. Key Share layers will be generated block by block using the half toned image and the random share. Starting from the top left block and moving left to right and top to bottom in raster format, the pixel at the top of each half toned block is checked. If the pixel in the half toned block is black then the corresponding block of Key Share will be filled by complementing the values of the two pixels in the corresponding block of the random share (Mask). On the other hand, if the pixel in the half toned block is white then the corresponding block of Key Share will be filled with the same values of the corresponding block of the random share (Mask), see Figure. The resulting layers (share 2R, share 2G and share 2B) are combined to form the key share (share 2). The key share is the same size as the secret image without pixel expansion so it does not require more storage space. Processing blocks of size 2×1 pixels in the steps of the encryption stage reduces the time of computation by half. The encryption algorithm that shows the steps of encrypting the colored secret image is shown in Figure 3. The encryption procedure of the colored secret image is illustrated in Figure

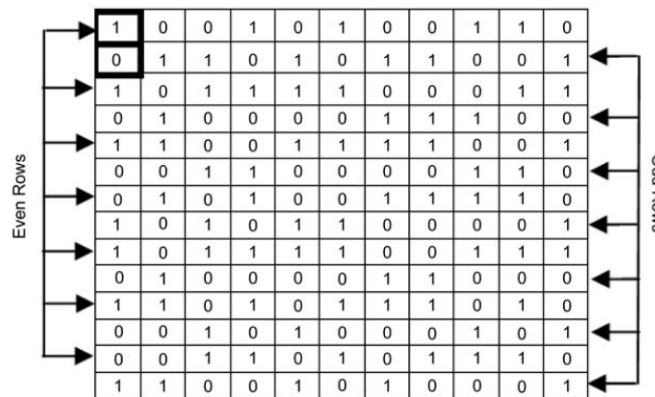


Figure . The generation of the Mask share.

Img block	Mask block	Share2 block						
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Figure block according to the corresponding Image block

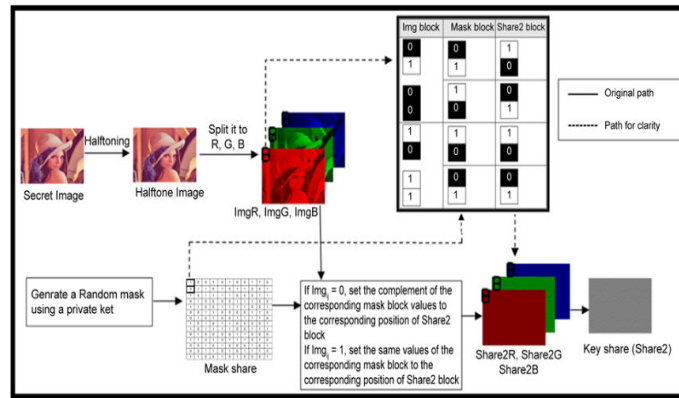


Figure the encryption procedure of the colored secret image.

In order to improve the value of PSNR and to increase the level of accuracy and security, we enhanced step 4 of the encryption stage in the proposed method. The proposed method and its enhanced form have been applied to a wide range of images of different sizes. PSNR values were calculated for both methods and compared to the results of using the traditional visual cryptography scheme. As shown in Table 1, we found that there is no apparent difference between the PSNR values of VC and the proposed method, whereas the enhanced form of the proposed method shows a significant improvement. From taking Leena image as an example, the PSNR value of the VC method is 30.1. While the PSNR

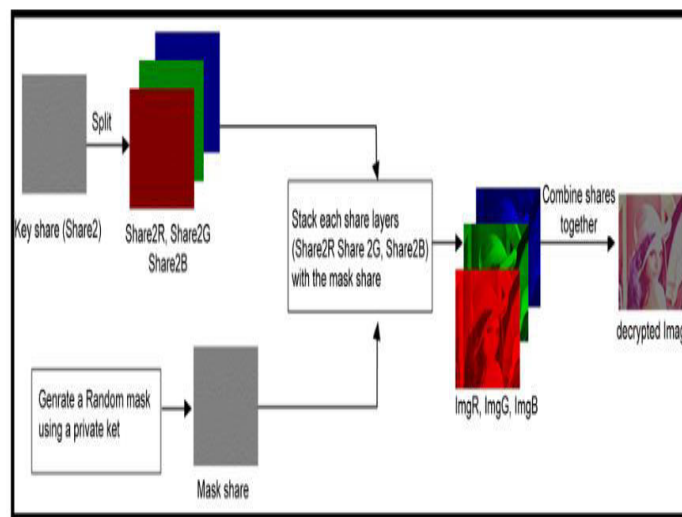


Figure. The decryption procedure of the colored secret image.

value of the proposed method is 28.93, which is very close. The enhanced form on the other hand gives a better result which is 34.17. The results in the last row of the table for the black and white Leena image, the PSNR values of the VC, proposed and enhanced methods are 30.5, 30.4 and 30.8 respectively. This proves that the results of the enhanced method are also better. This also can be seen for the Baboon and Word images where the enhanced method gives PSNR values of 34.75 and 38.04 respectively. These results can be justified in that there are four different cases of the two pixels in the 2×1 image blocks (see Figure 6). The cases where the two pixels in the image block are complements of each other, share blocks in the encryption step will be set with the same values of the corresponding blocks in the original image. On the other hand, if the two pixels taken from the original image are the same, then share 2 blocks will be set randomly according to the mask block. As we can see 50% of the cases after decrypting the encrypted image blocks remain the same as the original without any distortion. Furthermore, unlike VC, our methods encrypt the secret image without pixel expansion, thus creating an encrypted secret image having the same size as the original. The techniques we used also reduce the time of computation by half compared to VC because in the key share generation step, blocks of size 2×1 pixels are being processed in the encryption stage. A sample set of host images with different sizes is shown in

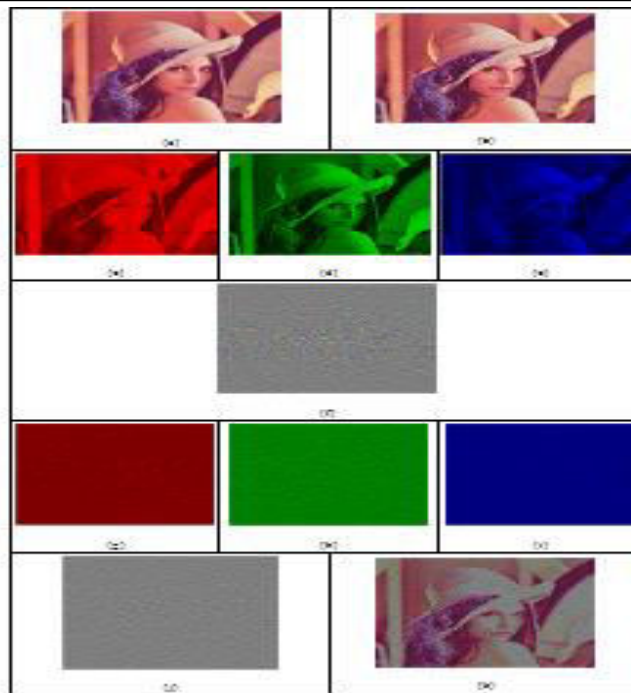


Figure.The decryption procedure of the secret image.

CONCLUSION

Visual cryptography is an encryption technique that has the advantage of using the human vision to decrypt the encrypted images without any cryptographic computations. On the other hand VC has suffered from pixel expansion. In this paper, the proposed and the enhanced methods overcome this by suggesting a new way of encryption without pixel expansion. Our methods require less space storage and less time for computation during the encryption process. The secret image is encrypted by splitting it into two shares, a random share and a key share. The key share is generated using the halftone image and the random share, and is then sent to the receiving side. The random share, on the other hand, is generated at both the sending and receiving sides using a private key. The secret color image is revealed by stacking the two shares and exploiting the human vision system. The proposed and the enhanced methods offer a good PSNR values compared to VC. As a future work, we will enhance our methods to encrypt halftone color images by generating meaningful shares as well as applying our methods in applications that require high level of security.

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A REVIEW OF MACHINE LEARNING IN BIG DATA ANALYTICS: APPLICATIONS, CHALLENGES, AND PROSPECTS**¹Dr. K. S. Gomathi and ²Ms. R. Mahalakshmi**¹Principal & Head, Department of Computer Science & BCA, MGNMRS College for Women (Affiliated to Madurai Kamaraj University, Madurai- 625021)²Assistant Professor, Department of Computer Science, MGNMRS College for Women (Affiliated to Madurai Kamaraj University, Madurai- 625021)**ABSTRACT**

The space of digital technology in the hands of every public worldwide makes an available unknown massive quantum of data. The capability to reuse these gigantic quantities of data in real-time with Big Data Analytics (BDA) tools and Machine literacy (ML) algorithms carries numerous requisites. Still, the high number of free BDA tools, platforms, and data mining tools makes it gruelling to elect the applicable bone for the right task. This paper presents a comprehensive literature review of ML in BDA, using a keyword hunt; a total of 1512 published papers was linked. The papers were screened to 140 grounded on the study proposed new taxonomy. The study outgrowth shows that deep neural networks (15), support vector machines (15), artificial neural networks (14), decision trees (12), and ensemble literacy ways (11) are extensively applied in BDA. Machine Literacy is a crossroad of AI and statistics and is the capability of a system to ameliorate its understanding and decision - timber with experience. colorful social operations of big data, videlicet, health care, social analysis, finance, and security, are delved with suitable use cases. There are two types of machine literacy algorithms supervised; and unsupervised. Support vector machines (SVM) are one of the supervised machine literacy ways. SVM can perform retrogression, outlier discovery, and direct and nonlinear bracket. A clustering fashion is used when the specific target or the anticipated affair isn't known to the data critic. It's popularly nominated as unsupervised bracket. In a clustering fashion, the data within each group are remarkably analogous in their characteristics. AI/ machine literacy is now pouring a trend towards the emergence of the operation subcaste of Big Data.

The combination of Big Data and AI will inconceivable invention across enough much every assurity. From that perspective, the Big Data occasion is presumably indeed bigger than people allowed. Enforcing a good big data strategy is veritably pivotal in order to guarantee the success of applying machine literacy for learning big data. This chapter explains the relationship between the conception of big data analytics and machine literacy, including colorful supervised and unsupervised machine literacy ways.

Keywords: Big Data Analytics (BDA), Machine Learning (ML), Big Data (BD), Hadoop, MapReduce

1 INTRODUCTION

Huge volumes of data are being generated every day in a variety of fields, from social networks to engineering and commerce to biomolecular exploration and phycology (1, 2). Digital data generated from colorful digital platforms and bias are growing at astounding rates worldwide. In 2011, digital information grew nine times in volume compared with 2006, and it's estimated to reach zettabytes by 2020 (1, 3). As of 16th December 2020, the volume of diurnal generated data encyclopedically was 59 zettabytes. It's anticipated to reach 149 zettabytes (4) in 2024 as we go into an indeed more data-driven future. The raising volume in data is the top trait of "big data", a slang that has come a manage name in the exploration communities, organisations, and the Internet.

Lately, Big Data (BD) and its arising ministry and ways, like Big Data Analytics (BDA), have converted the way that organisations and businesses operate, delivering new significant prospects for enterprises, professionals, and academia (5). Besides businesses and exploration institutions, governmental and non-government organisations now regularly induce massive unique compass and complexity data (7). thus, picking up meaningful information and precious advantages from these available big data has come vital to organisations worldwide. still, the literature shows that it's challenging to efficiently and adroitly decide helpful perceptivity from BD snappily and fluently (8). So, BDA has come indistinguishably essential to realise BD's total value to ameliorate business performance and increase request share to utmost organisations.

Indeed though utmost Artificial Intelligence (AI) and Machine literacy (ML) algorithms and their enabling platforms for performing BDA are free, they bear a new skill set that's uncommon to utmost interpreters in this field and organisations' IT departments (3). Hence, integrating these tools and platforms seamlessly into an organisation's internal and external data on a common platform is a challenge

Also, the vacuity of several ML algorithms possesses a challenge in making a good choice out of them, i.e., “ searching for a needle in a haystack ”. thus, performing a comprehensive relative analysis of BDA in different diligence with ML algorithms is necessary. also, big data come in a different format(structured,semi-structured, or unshaped) regarding the data source or assiduity. latterly, Ref.(9) has proven that ML algorithms perform else concerning input data format. therefore, an ML algorithm might fit better(high delicacy) on a structured dataset than on asemi-structured or unshaped dataset. It was also apparent in Nti etal.(10) that an ML algorithm might perform else under different ML tasks. For illustration, the same algorithm able of retrogression or bracket task might perform better in bracket than retrogression.

Hence, this paper investigates colorful literature on big data analytics with ML algorithms. We sought to review journal and conference published exploration papers relating to BDA using ML styles, similar as Artificial Neural Networks(ANN), Support Vector Machines(SVM), Deep Learning(DL), K- Nearest Neighbour(KNN), and numerous further, by(i) agitating some critical issues related to big data analytics, and pressing current exploration sweats and the implicit challenges in BDA and unborn openings and trends, and (ii) relating colorful ML ways for BDA from different methods.

The worth of the current study are as follows i) This study will help experimenters, IT departments, and professionals appreciate the right BDA tools and algorithms when carrying out big data analytics.(ii) It will also help new experimenters in BDA make an informed decision and a helpful donation to the scientific community.(iii) The outgrowth of this study will serve as a companion to the improvement of ways and tools that mix big data and cognitive computing.

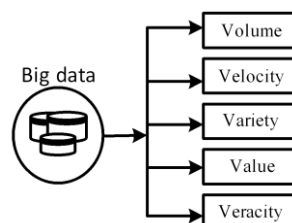
The main donation of the current study are as follows 1) An each- inclusive and detailed valuation of former state- of- the- art studies on BDA with ML ways; grounded on a new taxonomy(i.e., the type BDA, data size, study origin, ML task and system, and evaluation criteria);(2) A terse representation of the precious features of compared ways in BDA with ML; 3) A terse representation of the precious features of compared ways in BDA with ML; 4) We eventually give the implicit challenges, exploration trends, and openings for unborn studies in BDA.

RESEARCH LITERATURE

This section presents the conception of big data, big data analytics, and a review of affiliated work

2.1 Concept of Big Data and Big Data Analytics

According to Sujitparapitaya etal.(8), BD is the gathering of data in huge volume enabled by the recent advances made in technologies tools and platforms that support high- haste data prisoner, storehouse, and analysis. The conception of BD given by Doug Laney cited in Refs.(8, 11, 12) is ingrained by volume, haste, and variety, conceded as 3Vs. still, utmost studies(1, 7, 10) expand the conception of Doug Laney to five crucial characteristics(5 Vs), videlicet, volume, haste, variety, value, and veracity(seeFig. 1), i.e., the description for BD keeps varying following the advancement in technology, storehouse capacity for data, the transmission rate of data, and other system capacities(11). The first “ V ”(volume) denotes the data size, which swells exponentially with time(4). It's argued that the healthcare assiduity generates enormous quantities of data in electronic medical records compared with most diligence(11). The alternate “ V ”(haste) refers to the quickness at which data are generated and acquired from colorful diligence. The third “ V ”(variety) denotes the multifariousness and diversity of data.



The fourth “ V ”, value, to some experimenters, is the most vital and irreplaceable specific of all the 5 Vs of BD, as they believe it has the power to convert assiduity data into a piece of precious information. The fifth “ V ” (veracity) refers to the credibility of the data, which in this environment is veritably analogous to quality assurance of data. It gives a degree of fictitiousness about a particular sector knowledge

According to Russom(13), BDA is applying advanced logical styles and ways on big datasets. also, BDA can be defined as the process of collecting, systematising, and scrutinising DB to image and display patterns, discover knowledge and intelligence along with other information in the BD(5). therefore, BDA virtually involves two effects, big data and analytics, and how these two have teamed up to produce one of the inviting

current trends in Business Intelligence(BI). BDA consists of BD descriptive, BD prophetic , and BD conventional analytics(5, 14)(seeFig. 2). therefore, BDA uses data analysis ways to uncover patterns in call logs, mobile banking deals, and online stoner- generated content. The ground rules of BDA correspond of engineering, mathematics, mortal interface, statistics, information technology, and computer wisdom. presently, BDA is the new big data technology that has come extensively embraced across sectors,

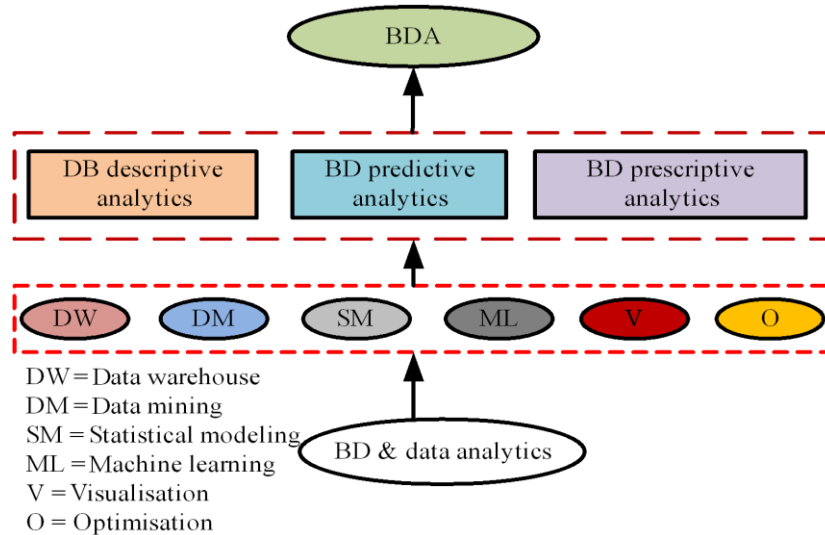


Fig. 2 a taxonomy of BDA.

Presently, BDA is the new big data technology that has come extensively embraced across sectors, companies, geographic areas, as well as among individualities, to help businesses and individualities make data- driven opinions to negotiate asked business pretensions (5, 15 – 18). Of late, BDA can be enabled by several logical platforms and tools, including those grounded on Structured Query Language (SQL) queries, fact clustering, data mining, natural language processing statistical analysis, data visualisation, AI, ML, textbook analytics, MongoDB, Hadoop, and MapReduce. The platforms and tools available to handle the 5Vs of big data have bettered dramatically in recent times. In general, these technologies and tools aren't absurdly precious, and much of the available software is open source.

Figure 3 shows the introductory applied theoretical armature of BDA(11, 19). ML algorithms have come dominant in analysing, visualising, and modelling big data. ML makes machines learn from a dataset in its introductory description, apply their knowledge and sapience on unseen data, and make prognostications.

The literature reports the success of ML algorithms in different operation areas (Table 1). From the literature, ML can be categorised into four classes, videlicet (i) supervised literacy, (ii) unsupervised literacy,(iii)semi-supervised literacy, and(v) underpinning literacy. innumerous ML algorithms are available freely for performing ML tasks, like bracket, retrogression, clustering, dimensionality reduction, and ranking. To name a many, SVM, ANN, DT, Naive- Base(NB), Tensor bus- Encoder(TAE), Ensemble Learning(EL), KNN, Hidden Markov Model(HMM), Singular- Value corruption(SVD), Radial Base Function Neural Network(RBF- NN), star element Analysis (PCA), Generative inimical Networks(GANs), Natural Language Processing(NLP), intermittent Neural Network(RNN), Bidirectional Gated intermittent Unit

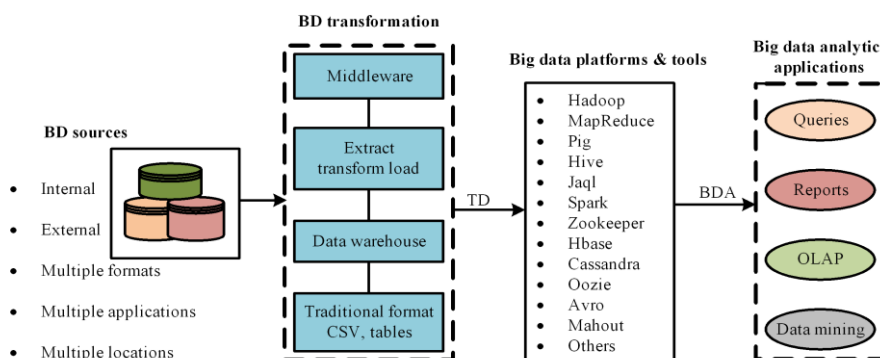


Fig. 3 A theoretical architecture of BDA. Here TD represents transformed data.

Table 1: Machine learning application in different economic sectors by academicians and industry professionals.

Reference	Application area
[10, 20–23]	Finance and stock market
[24–26]	Energy system forecasting and faults detection
[27–29]	Healthcare
[30–33]	Teaching and learning
[34–36]	Agriculture (crop yields, emissions, and disease detection)
[37]	Transportation
[38]	Petrology

2.2 RELATED WORKS

The vast number of BDA papers makes it delicate for interpreters and experimenters to keep up with developments in the field. thus, some once studies tried to summarise different ML operations in BDA and its advancement to help beginners elect the correct ML algorithm for BDA. still, quite a number of these studies were narrowed to BDA on specific diligence, similar as healthcare(17, 39 – 45), air quality(46), Internet of effects (IoT)(47 – 49), husbandry(50), and information security(51). also, Refs.(1, 7, 13, 19, 52 – 61) concentrated on the overview, challenges, and approach in BDA. Likewise, Ale(62) presented the threat analysis of BD. In discrepancy, Ref.(63) covered BDA in different areas yet concentrated on model effectiveness and computational cost.

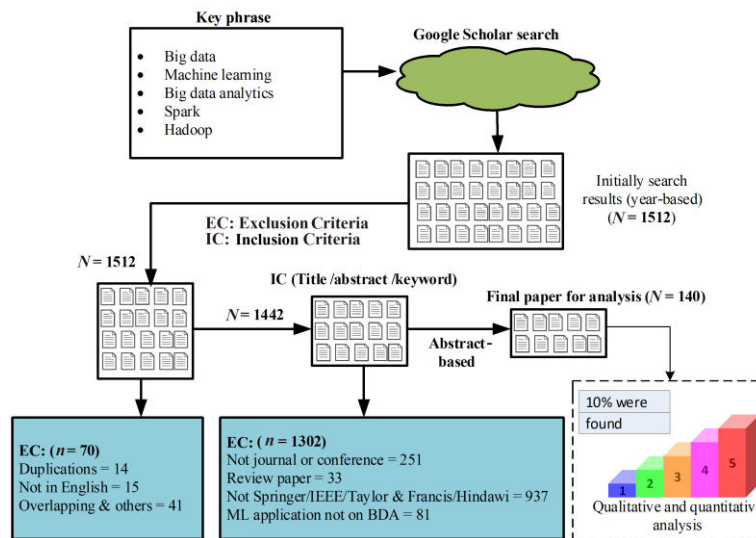
Eventually, Fathi et al.(65) reviewed BDA in rainfall soothsaying. According to our knowledge, little has been done on ML advancement and big data analytics in different diligence, like healthcare, husbandry, energy, engineering, and more. None of the earlier studies has adequately addressed this challenge; still, big data make swells across every profitable sector. Hence, it will be illegal to constrict the big data analytics review in a single or binary assiduity. likewise, in light of the forenamed sweats, we could identify the following excrescencies in previous workshop

- 1) The paper selection process in some papers, similaras Refs. [1, 63, 66], was not clear.
- 2) utmost of the studies, like Refs.(1, 7, 13, 19, 52 – 61), did not consider the origin of the papers.
- 3) None of the being demonstrated clear statistical information on the BDA platforms and modelling tools.
- 4) None of the studies bandied over considered the objects of the papers they reviewed. As a result of the pronounced reasons, we're happy to propose a Mini Literature Review(MLR) report that addresses all of the excrescencies mentioned over.

3 METHODOLOGY

According to Lorna (67) and Elfar(68), MLR seeks to snappily and fluently show, a specific issue or set of affiliated motifs, and emphasise where there are gaps in the literature and possibilities for farther exploration. An MLR is generally shorter than a full- fledged literature review. That's because, unlike a literature review, which focuses on synthesising findings from several studies to develop conclusions on a broad area of exploration, an MLR focuses on a single subject or content. It's vital to flash back that the literature review and the MLR format are the same. Likewise, there's no substantial difference between the way involved in MLR and the literature review(67, 68). still, the only difference between the two is that one is broader while the other is narrower. We espoused MLR because its terse format makes it simple to grasp those themes in the literature, allowing further interpreters to benefit from them.

Figure 4 shows the review process in this paper; five guidelines are followed, i.e.,(i) search strategy,(ii) selection criteria, (iii) study selection process,(iv) quality assurance, and (v) qualitative and quantitative analysis. Eventually, we explain in detail what's fulfilled in each step. Google Scholar was espoused as the central hunt machine platform for collecting applicable papers due to its open access and its date restriction inflexibility. still, only applicable journal and conference papers were downloaded. Five top expressions defined by the authors were used in the hunt, “ big data ”, “ machine literacy ”, “ big data analytics ”, “ Apache Spark ”, and “ Hadoop ”. still, we gain several affiliated queries to our five keywords using Google trends. The following are a many of them that were espoused in these study as supplementary words “ big data and data analytics ”, “ analytics of big data ”, “ business analytics ”, “ big data business analytics ”, “ analytics big data ”, “ data analytics ”, “ analytics ”, “ Hadoop ”, “ big data Hadoop ”, “ deep machine literacy ”, “ deep literacy ”, “ Hadoop spark ”, “ spark Apache tutorial ”, “ Scala ”, and “ Hadoop hive ”. Figure 5 shows the trend on big data analytics from Google trends.



The papers were considered grounded on an agreed addition- rejection criterion by all authors. The addition criteria are as follows (i) the composition is written in the English language,(ii) the composition must relate to big data and DBA,(iii) composition published between – 2021, and(iv) composition must be published in a journal or conference.

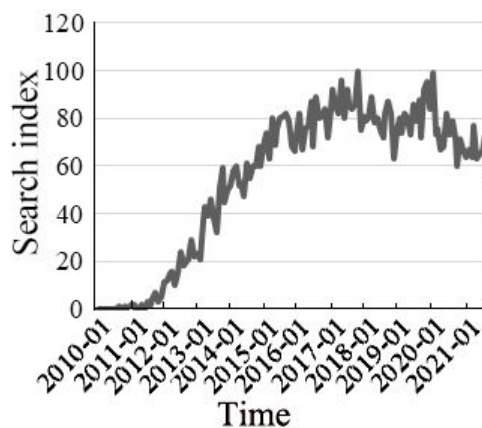


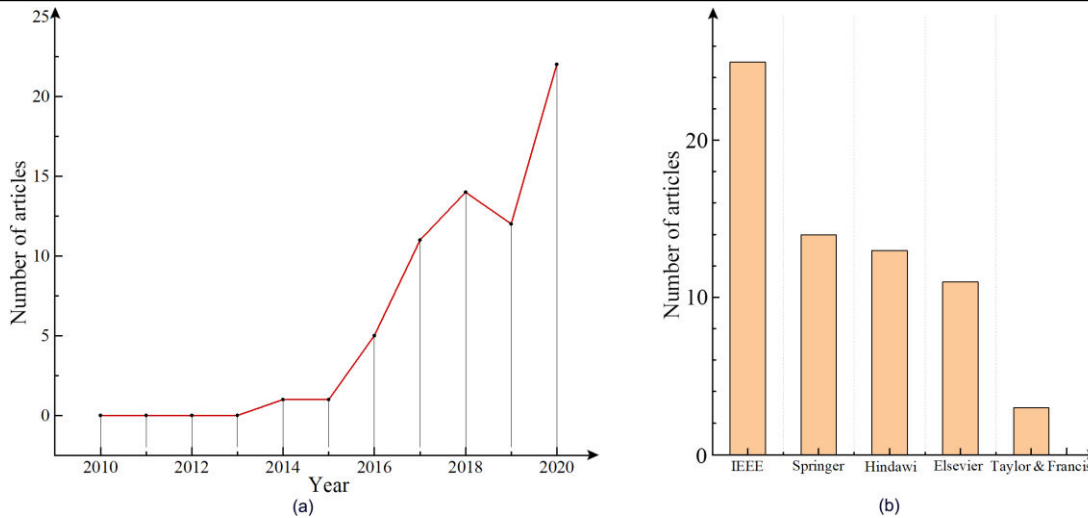
Fig. 5 Trend on Google search queries on big data analytics.

4 RESULT AND DISCUSSION

This section presents the outgrowth of the 66 papers that were analysed quantitatively. The review shows that current exploration on BDA can be categorised under five different themes, videlicet,(i) core BD area to handle the scale,(ii) managing noise and vagueness in the data,(iii) sequestration and security aspects,(iv) data engineering, and (v) rendezvous of BD and data wisdom. Table A1 in excursus summarises the papers reviewed in this study; it presents the operation area, the papers ’ objective, and the data size used. Grounded on the ontology proposed in Sun et al.(5)(2), this study grouped the type of big data analytics into three, videlicet,(i) BD descriptive analytics(denoted as “ A ”),(ii) BD prophetic analytics(denoted as “ B ”), and(iii) BD conventional analytics(denoted as “ C ”). Out of the 66 papers, 56 indicated the operation sphere. It was observed that 58 of the reviewed papers(15, 69 – 99) were grounded on BD prophetic analytics, BD conventional analytics(103 – 105), 11 BD descriptive analytics(15, 69 – 99), whiles 9(A B)(100 – 105) and 5(B C)(106 – 108).

4.1 Time Trend Publication

Figure 6 shows the time trend in publication and publisher wise distribution. Although the review limited the literature hunt between 2010 – 2020, it was observed that exploration work in ML operation in BDA started entering a rise in attention from academicians and professionals in the last five times and since has increased precipitously, supporting the report in Ref.(11). nevertheless, BD has been around for decays; still, it has only taken on from a word- buzzed in recent times. likewise, it can be inferred that the tremendous rise in BD in current times(4) has attracted experimenters ’ attention to examine the benefit that can be effectively deduced from this vacuity of data to make an informed decision.



4.2 Big Data Platforms Tool in BDA

Table 2 shows the generally used DBA platforms and tools. Out of the 66 papers, 43(65) indicated the BDA tools used for their experimental analysis. Indeed however Hadoop is believed to be the most potent and popular tool in BDA(8, 113), our results show else. We observed that Spark is the top most used(34.88) tool for DBA among experimenters in this field, followed by Hadoop(30.23). This finding can be attributed to Spark being briskly and lightly to use for big data analytics than Hadoop MapReduce. Also, it's believed that Spark offers high processing speed than Hadoop(103). likewise, Hadoop doesn't offer data- pipelining, and it isn't easy to use.

Table 2: BDA platforms and tools.

BD platforms and tools	Number of papers	Percentage (%)
Flink	1	2.33
Apache Mahout	1	2.33
HiBench	1	2.33
H2O	1	2.33
MATLAB	5	11.63
MapReduce	6	13.95
Apache Hadoop	13	30.23
Apache Spark	15	34.88

Figure 7 shows the ML ways substantially used for BDA. The outgrowth suggests that artificial intelligence and ML will continue to hit the roof as further enterprises and diligence look forward to transubstantiating their day-to-day business, maximising profit, while minimising threat. The SVM is set up to be the most extensively(14 out of 66) used machine literacy algorithms in big data analytics because of its capability to work(i) nearly without previous knowledge of the dataset and(ii) on high dimensional and the threat of over-fitting.

The Decision Tree (DT) algorithm, however simple, is the third most used ML algorithm in BDA. According to Celli et al.(93), DTs are smooth to understand. also, they validate the model with statistical tests(like entropy or information gain), contributing to its fashionability in BDA. Another thrilling disclosure is that utmost studies(70, 77, 79, 84, 94, 97, 106, 108, 116 – 121) used Deep Neural Networks(DNN), similar as LSTM and Convolutional Neural Network(CNN), as shown in Fig. 6.

This outgrowth can be attributed to LSTM's storing memory and working the grade evaporating problem; CNN can automatically notice and prize the applicable internal structure from a time series dataset to produce in-depth input features, using complication and pooling operations. Also, CNN and LSTM algorithms are flexible to noise forbearance and delicacy for time- series bracket.

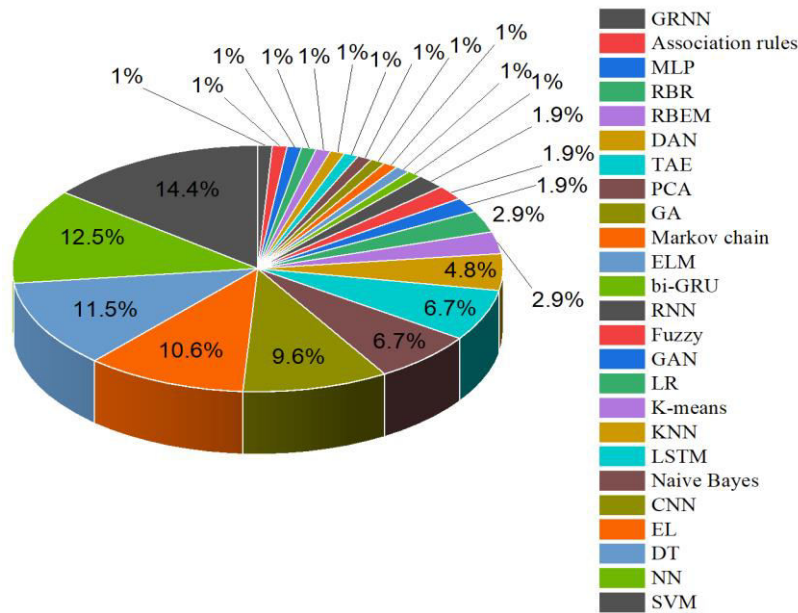


Fig. 7 ML techniques mainly used for BDA.

4.3 Country-Wise Distribution of Publications

Figure 8 shows the distribution of papers across countries. It was observed that utmost of the studies were accepted in China (36.4), followed by the USA (18.2). Though Srivastava (123) reports that the USA leads China interns of DB adaption in 2019, this study shows that further studies in BDA analytics evolve from China than USA. This outgrowth is no surprise since a report by www.statista.com shows that China has the loftiest mobile phone druggies, followed by India and USA. The outgrowth is no surprise since China’s population is of the total world population. thus, it canbe inferred that China generates further electronic data from mobile phone druggies than any other country; hence, further exploration is demanded in big data. Interestingly, in the 66 papers, Africa is recorded none; thus, we encourage analytics in the big data generated from the mainland to enhance business opinions

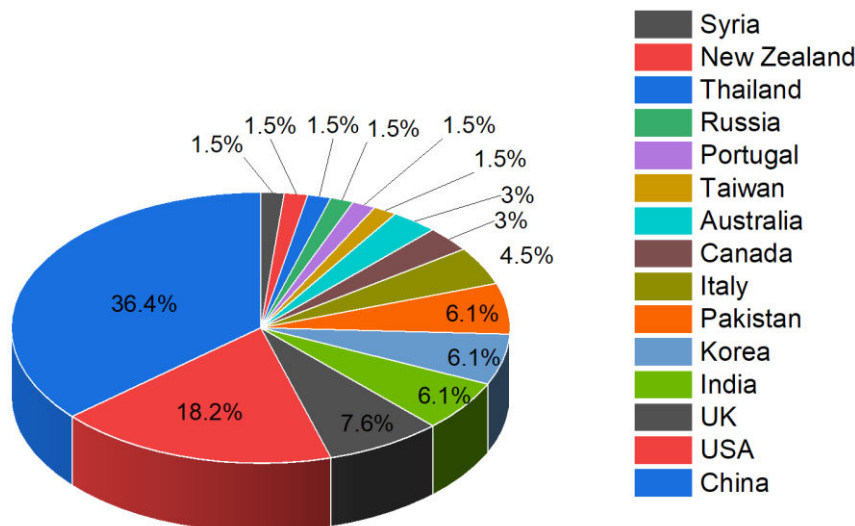


Fig. 8 Publication origin distribution.

4.4 Evaluation Metrics Used in BDA

Several evaluation criteria can be used to measure a machine literacy model’s performance, depending on the ML task(9). Some of the most common are Mean- Square- Error(MSE), Root- Mean- Square- Error(RMSE), Mean- Absolute- Error(MAE), delicacy, perfection, recall, Area- Under- the- wind(AUC), and F- score. For further details and delineations of the colorful evaluation metric, compendiums are appertained to Ref.(9). Figure 9 shows the distribution of error criteria used in BDA. It was observed that delicacy(37) was the most habituated metric because utmost papers were BD prophetic analytics. thus, it’s argued that combining delicacy and error criteria offers a better ML model evaluation(10). We observed that several studies(70, 83, 85, 87, 88, 92, 95, 97, 104, 108, 117, 119, 122, 124, 125) combined two or further criteria to estimate their models and frame.

4.5 Major Keywords (Use Keywords of Papers)

Figure 10 shows a plot of the keywords used in the BDA exploration. All keywords used in the 66 papers were copied in a textbook train; using a python API(word shadows), we colluded an image of generally used keywords forresearch papers in BDA. The end was to measure the correlation between keywords used in big data analytics. A aggregate of 360 words were attained afterpre-processing; it is essential to note that words with a frequence less than or equal to 2 were exempted from the plot. As seen inFig. 10, big data, machine literacy, analytics, network, and Spark are constantly used by exploration papers in BDA. A careful look atFig. 9 shows that Spark is more significant than Hadoop; this affirms the results bandied in Table 2, that Spark is generally used among experimenters in BDA than Hadoop. From Fig. 10, it's apparent that there's a high relation among the keywords used by different experimenters in BDA.

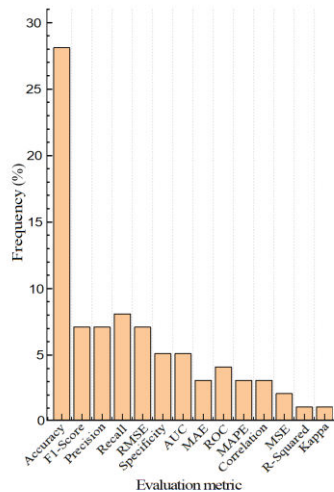


Fig. 9 Evaluation metric distribution.

5 CONCLUSION

The current studies reviewed past studies on big data analytics with machine literacy operations in different profitable areas. A aggregate of 1512 papers published in journals and conferences were downloaded using keywords hunt in Google scholar. The downloaded papers were screened through several stages, and the final named papers (140) were reviewed grounded on a proposed taxonomy. Grounded on the analysis we have presented in former subsections and the summarised information in Tables 2 and A1 andFigs. 6 – 10; it is egregious to fantasize the most habituated tools for this review, the trend of exploration work over the times, besides mentioning several openings for unborn workshop. We stopgap that this study will prop experimenters and assiduity professionals with a precious base for farther studies to comprehend the complete environment of big data analytics with machine literacy and its operations in several diligence.

5.1 Key Challenges in BDA

Big data analytics challenges have been echoed in once studies(1, 7, 12, 13, 19, 52 – 61) of analogous objects as this paper; still, the following are many linked to add Fig. 10 Keywords generally used in BDA exploration. up or affirm literature. 1) Ethical issues It was observed that there are several ethical issues, similar as brand(reusability without authorization), sequestration, and involvement of the rival organisation associated with big data.



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WEB DISCOVERY TOOLS: CONCEPT AND CHALLENGES**Hilala Ariyana¹ and Dr. Bhoop Singh²**¹Research Scholar and ²Assistant Professor, Bhartiya Skill Development University**ABSTRACT**

Libraries always concerned with the accessibility of the information resources to the users. Nowadays, with the rapid development of the electronic information resources the libraries are more focused on the subscription and management of these e-resources. For e-resources and their management libraries need to adapt several web based techniques to manage the electronic resources and provide seamless access. Web discovery tool is one of the tools used for providing a single access point to all the information resources of the library. This paper explores the concept of web discovery tools. Also, highlights some of the specific advantages of the tools to support the access to the e-resources. The paper divided into different sections that includes concepts of web discovery tool, expectations, advantages and limitations of web discovery tools and also discussed few case studies on Web discovery tool implementation.

Keywords: Electronic resources/e-resources, e-resource management, Web Discovery Tool, Library, Academics Libraries.

INTRODUCTION

Libraries of Higher Education Institutions are always ready to grow in every aspect including collection development and advancement in tools and technology to support the information process, access and retrieval. The discovery of the available information in the library is an important aspect to make the utilization of them. Discovering Resource involves locating information resources and providing interrupt access to the users across a local and remote collection of the library. Library discovery tools are intended for intelligent searches for educational or research purposes (Shi and Levy, 2015). A library discovery tool is defined as a search engine that builds on unified indexes of licensed scholarly information, searches across multiple library databases provided by different vendors, and maybe customized for its size, range and comprehensiveness of data inclusion for targeted solutions. The discovery layer provides single access to all the resources in the collection. Web discovery Tools holds the ability to improve the access in the library holdings and the way users discover and interact with those holdings. The study will explore several aspects of web discovery tools including concept, need, their familiarity in library environment and awareness about the technical aspects of the discovery system.

OBJECTIVES OF THE STUDY

The objectives of the study are as follows:

- To study the concepts and challenges of the web discovery tools.
- To study the factors for consideration while selecting web discovery tools
- To study the emerging need of the web discovery tools in the Academic Libraries of India.

LITERATURE REVIEW

These are some studies reviewed on importance and applications of web discovery tools and services for academic libraries Sachin & Kumar, 2018; Mandal, (2018); Sujatha & Reddy, (2014). Burke, (2010) described library “discovery services” are a continuum of solutions. This continuum is based on three categories of services: Discovery Layer (also known as “next generation catalogue”); Federated Search and; Web-scale Discovery. Han, (2012) discussed how the multi discovery services (including VuFind, Easy Search, WebVoyage) works in the University of Illinois Library. The main criteria taken was how these discovery systems uses the cataloguing records and challenge to current bibliographic control that supports the discovery systems in meeting users needs and improving access to and retrieval of resources. Chickering & Yang, (2014) evaluated fourteen discovery tools based on sixteen criteria recognised as advanced features of next generation catalogue. These sixteen criteria include: One-stop search; State-of-the-art web interface; Enriched content; Faceted navigation; Simple keyword search box with a link to advanced search at the start page; Simple keyword search box on every page; Relevancy; Did you mean; Recommendations; User contribution; RSS feeds; Integration with social networking sites; Persistent links; Auto-completion; Mobile compatibility; Functional Requirements for Bibliographic Retrieval (FRBR) relationships. The findings of the study show the availability/non-availability of these sixteen features in selected web discovery tools. Shi & Levy, (2015) provided a practical analysis of available discovery tools in the context of open source search engines on the

internet. The study revealed that the different features of these discovery tools (like manage library collection, provide access, budgetary consideration) will help the libraries in choosing the options for their library to fulfil the information need of users. The study did comparative analysis of commercial search engine with the library discovery tools, on the basis of users search experience and factors preferred to select the search engine by students of SUNY Rockland community college. **Hazra, (2017)**, identified nine parameters to evaluate and compare the discovery software; these parameters are helpful to select the discovery tool for the library. These are: Federated searching; Smart searching; Advanced searching; Scoped searching; Faceted browsing; Visual searching; Search limits; Recommendations/related materials. **Gupta & Shrivastava, (2019)**, surveyed to find out the awareness and usage of discovery tool among library professionals. They used structured questionnaire to collect the data from different libraries. The finding shows that there is a need of awareness about new technologies (for instance, federated searching, discovery tools next generation catalogue and web discovery tools) among the library professionals.

Case Studies on Web Discovery Tools:

This section contains review of few case studies on Web Discovery Tools

Case Study 1

Comeaux, (2012) showed the usability testing of Primo web scale discovery tool at Tulane University. The study includes 11 undergraduates, 4 graduates and 5 faculty members to perform 5 tasks to test the various key aspects (facets, the ability to access full text, and the ability to make a request on an item) of the discovery system. The findings show Primo is confusing to the users in finding the known item in a single search result screen with the other items. Location of the resources displayed in the primo is also not clear to the users. Inter Library Loan facility provided through the Primo and request to the item feature are also not clear to the users.

Case Study 2

Chatterjee & Das, (2015) discussed about the in house developed discovery service “eSearch Software” by Central Library of IIT Kharagpur. According to the authors the eSearch software is web application software and is very handy and useful to those users who are searching books with title name. The limitation of the discovery service is it does not perform any full text search.

Case Study 3

Dhamdhare & Lihitkar, (2016) did a case study of integration of Google CSE at Modern College of Arts, Science and Commerce, Ganeshkhind, Pune. Before implementing the Google CSE the library provides links of all the free and subscribed databases through portal. Google CSE is an open source discovery tool and is very easy and simple to implement. The study revealed ten major steps were considered to implement Google CSE: i. need to have Account; ii. login to Google account give the link <https://cse.google.com/cse/>; iii. need to create custom search; iv. enter the site or database search site in column “site to Search”; v. adds name of search engine; vi. click on create, the databases are added in your search database; vii. custom search engine successfully created; viii. modification can be done from control panel; viii. from “look and feed”, look and pattern modification can be done; ix. get a url or code for your custom search engine from the setup menu, which will add on the library website men or web page: x. search engine is ready to use by users.

Case Study 4

Dhara, (2017) discussed about the small-scale personalised discovery service designed for the Ramsaday College Library in Howrah, West Bengal with the use of Google CSE. The author described the process of implementation of Google CSE and its integration with the library OPAC to provide one stop access to the users of the Ramsaday College Library.

Case Study 5

Roy, Biswas & Mukhopadhyay, (2018) developed a prototype web-scale discovery system by using different open source software. The prototype resource discovery framework was able to integrate with any web-enabled online information system. The study is based on the integration of VuFind with Koha and Dspace, along with different databases (commercial/licensed/license-free/open access). The bibliographic data are taken from different databases like IndCat and the Library of Congress to populate Koha and Dspace and then VuFind.

METHODOLOGY

The paper is based on the literature explored and reviewed in context of Web Discovery Tools. The author explored the concept of web discovery tool and revealed the opportunities and challenges of Web Discovery Tools for the academic libraries with the help of few practical case studies. The paper is based on the

information taken from different primary, secondary and tertiary information sources published in different journals, magazines, books and websites. The paper explores several aspects of web discovery tools from the available studies.

Web Discovery Tools: Concept and Challenges

The concept of web discovery tool was came into existence with the elevated need of a single search platform having the ability to provide access to the whole information resources of the library with relevance ranked result and consuming less time. The concept of web discovery tool is introduced by Breeding in 2005, just after the launch of Google Scholar. The discovery services provided a user friendly interface to search the information resources by the users. The web discovery tools have three major components a user friendly single search window and the central index and a result page which contains relevant information from different sources of library collection. Discovery tools supports a user friendly interface with search and retrieval capabilities and have features included relevancy-based ordering of search results, facets result according to specific categories, contributors, or date ranges, and tools to identify related materials or to refine search queries (**Khiste & Deshmukh, 2017**). The major discovery tools found in literature included: EBSCODS, Summon, Google CSE (open Source), Primo, VuFind (open Source), and WorldCat Local-OCLC.

Definition of the Web Discovery Tools

Web Discovery Tools are used as a search engine and provide a single search (like Google) of the world of online catalog, databases, e-journals, digital collections, etc. either licensed, open access or institutions own. These tools use their own indexes to the library e-resources and then match the need of the information user and offer a consistent search result. Authors defined discovery services in the context of resource discovery and access to the library collection. **Sarkara and Mukhopadhyay, (2016)** described the discovery interface as “next-generation catalogues” with advanced end-user interface, have the ability to replace OPAC modules in Integrated Library System (ILS). Discovery services provide an interface (includes faceted navigation relevancy-based search results) with simple Google like single interface through with users can put their query for information. **Sonawane, (2017)** highlighted the discovery services as “the extension of the third-generation library catalogues”. The discovery tools are used as a search engine and provide a single search (like Google) of the world of the online catalogue, databases, e-journals, digital collections, etc. either licensed or open access.

Applications of Web Discovery Tools in Delivering Library Services

Web discovery tools have various advantages over other discovery tools used by libraries like OPAC, federated search system or AtoZ listing of resources over the website of the library etc. They can be good starting point for conducting a search for information for all kind of information seekers. The exigent advantage of web discovery tool is it have the ability to provide a single access point to the whole collection of the library either subscribed or unsubscribe and print or electronic information resources. The other advantages include relevance result, relatively less search time, make users familiar with the library resources, locating references for known resources, support search on subject specific databases, provide access to full text resources directly (**Courtney, 2014; Breeding, 2014; Gustavsson & Karlsson, 2015**). Also in full-text downloads (**Greiner, 2011; O'Hara, 2012**). Web Discovery Tools played important role in providing a single search window for all the e-resources weather subscribed or owned by the library. The tools have very recent involvement in libraries for finding the e-resources, such as electronic databases and full-text journal articles, separate indexes (**Popp, 2012**). They are available both as commercial and open source tools.

Factors for Consideration While Selecting Web Discovery Tools

The major factors for consideration while selecting web discovery tools: price, content, staff and technology and also vendor support and necessary training sessions (**Sachin & Kumar, 2018**). **Deodato (2015)** proposed the five key principles to evaluate any discovery tool these are inclusion, goal-oriented, data-driven, user-centred and transparent. He suggested an evaluation plan in eight steps which helps the academic libraries to make an evaluation before making a decision of implementing a discovery tool. Also, offered five main requirements to select Web Discovery Services: content, functionality, usability, administration and technology. **Goodsett (2014)** did the comparative study of three discovery services EBSCO Discovery Service, Ex Libris' Primo and Serials Solutions' Summon. The major criteria are used for the comparison are price, content, user experience, feature and functionality and back-end configuration. The author suggested that though these tools have various strengths and weakness, but the decision of making selection of these tools varies with the need and situations of the institutions.

The emerging need of the web Discovery services in the Academic Libraries of India:

The inclusion of vast varieties of e-resources in the libraries and the impotence of the traditional tools, and search services makes the way to the development of the web discovery tool.

CONCLUSION

In literature various authors highlighted that web discovery tools have the ability to change the nature of library systems. **Dhamdhare & Lihitkar (2016)**, suggested that discovery tool is needed to manage the complex, expensive and challenging process. There exist several systems like integrated library management system, authentication system, link resolver service with knowledgebase, the listing of e-resources, etc. used to manage the e-resources in the academic libraries. Nowadays, Web Discovery Tools getting attention by libraries to improve the discovery and access of the e-resources and provides one single search window for all resources. There is a need to study more about these tools and utilize them more beneficial for effective resource discovery in the libraries.

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MATHEMATICS FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Many people believe there is no connection whatsoever between Mathematics and Sustainable development. However, the Sustainable management practises or challenges are extremely complicated and present large mathematical models, methodologies, and challenges that call for more sophisticated scientific, mathematical, and statistical tools. In order to solve environmental management issues from a sustainable point of view, mathematical and numerical models, as well as soft system methods, rely on dynamical systems in control theory as well as practise at balancing economic and ecological factors. Mathematical techniques can be used to merge public and social choice traditions with multi-criteria decision analysis in order to address sustainability paradoxes in a complex environment with numerous dimensions, values, and scales. To assess sustainability, mathematical model applications are inevitably required. This article aims to discuss why Mathematics is important for Sustainability and the applications of Mathematical modelling in Sustainable Development.

Keywords: 2030 Agenda Sustainable development goals (SDG) Systems analysis Network analysis Policy coherence, Challenges, dynamical systems, environmental management, mathematical models, soft system methodology, sustainable management.

INTRODUCTION

It is clear that we need to make significant strides in our understanding of the natural world and the issues that have begun to emerge in order to prepare ourselves to live sustainably in this constantly changing planet. We need to move forward with correct quantitative procedures that are offered with the merging of Mathematical and Statistical tools in order to sustain and address those issues. Without a question, the most important task facing humanity is ensuring a sustainable future for future generations. This task also poses an excessive number of scientific and mathematical obstacles. However, putting that concept into practise is easier said than done as mentioned by Solow in 1991 [7]. The "Technology of Sustainability" is currently on the rise to address the most important cross-disciplinary questions. And for such technology, the mathematical sciences must provide the accurate, quantitative insights. But before that let us try to understand what is Sustainability and why is it required?

What is Sustainability and why is it required?

Sustainability is defined as the satisfaction of existing demands without compromising those of future generations. It also refers to preserving and achieving a balance between economic development, environmental protection, and social and physical well-being.

According to the Brundtland Report, sustainable development is defined by the UN as growth that satisfies current demands without risking the capacity of future generations to fulfill their own needs. The report concentrated on the idea that because there are only so many resources available to the current generation, it is important to use them judiciously and carefully so that future generations can obtain the resources they require without sacrificing the current standard of living or quality of life. A sustainable society must prioritise social responsibility, environmental protection, and a robust balance between the use of natural resources and the lives of the current population.

Why is Sustainability Important?

Both short-term and long-term perspectives can be used to understand the significance of sustainability. Making sustainable decisions is necessary for us to continue functioning as we do today and to preserve the world's ecosystem. If we do not start proactively addressing the issues, it is extremely likely that we will soon run out of fossil fuels, cause the extinction of several animal and bird species, and permanently harm the atmosphere. Sustainability is crucial and unavoidable in order to manage these damages and protect the resources.

Social, economic, and environmental are the three categories into which the components of sustainable development are divided. As suggested by authors in [1] regarding the necessity of sustainable development: In order to address the following difficulties, the concept of sustainable development is crucial:

- 1) Stop environmental deterioration
- 2) To protect human life;

- 3) To examine and identify alternatives to exploitative technologies
- 4) To monitor covert resource exploitation and waste
- 5) Regenerating sources of renewable energy, etc.

What are the 3 Pillars of Sustainability?

Three pillars—environmental, social, and economic—also known as profits, planet, and people—make up the concept of sustainability. These are especially important to corporate sustainability initiatives and those made by businesses.

1. **Environmental protection** – Environmentalists have long put a high value on nature and have viewed the earth as a place that should be conserved for humankind so that all living things can coexist peacefully and continue to develop over time. By lowering risks and assessing how diverse firm activities affect the environment, the protection of the environment has always been a top priority.
2. **Social Development:** The environment has always been important to environmentalists, who see the world as a place that needs to be protected for the sake of humanity so that all living things can coexist peacefully and continue to develop over time. The goal has always been to safeguard the environment by minimising risks and assessing how different business operations affect the environment.
3. **Economic Growth** is most likely the most basic type of sustainability. A company needs to be profitable and generate enough income to be in operation in the long run for it to be economically viable. Finding equilibrium is difficult with this type of sustainability. Therefore, the use of renewable energy and product recycling are essential components of the growth of the economic pillar. Rather than pursuing profit at all costs, businesses should seek to achieve profit in line with other aspects of sustainability.

What is Mathematics?

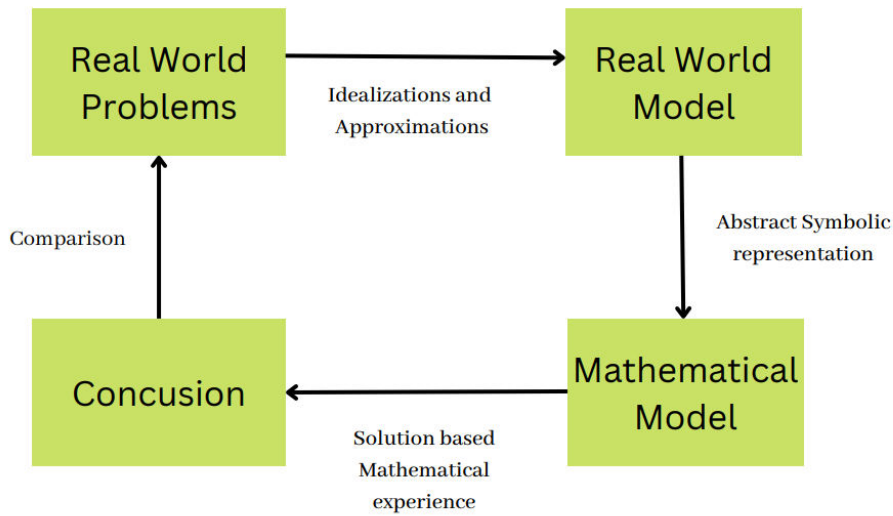
The reason why Mathematics is necessary for sustainability is now a question. In terms of energy sustainability alone, mathematics may make a significant contribution by improving combustion efficiency, developing alternative energy sources, managing energy grids and networks, and reducing the effects of energy consumption on the environment. Mathematics has an equally widespread and crucial role in the sustainability of financial markets and economic institutions. They are posing never-before-asked mathematical and statistical issues, and as of yet, we don't know the solutions. Nearly every sustainability issue we encounter calls for new mathematical techniques. Researchers have previously looked into how students perceive statistics, a subject included in our mathematics degree and a potential area of specialisation for them [6]. The authors discovered a notion of statistics (and subsequently of a branch of mathematics) in this region, which we would rank before the first conception (Components) in their list. They said that students' attention is focused on discrete mathematical or statistical approaches rather than on how such techniques may be used to solve real-world mathematical or statistical problems. Therefore, it's crucial to emphasise to the students how vital mathematical tools are in solving the sustainability challenge.

A mathematical relation that describes a certain situation in real life is known as a mathematical model. The majority of human activity on the earth is supported by mathematical models. Numerous problems in daily life are solved using mathematical models, including:

- 1) Satellite launch mathematical modelling.
- 2) Urban city planning mathematical modelling.
- 3) Mathematical modelling for reducing vehicle-related pollution
- 4) The mathematical simulation of stock market options or highway traffic flow.
- 5) Mathematical models that explain how various organs work.
- 6) Mathematical theories that predict India's population in 2050 AD (without waiting till then)
- 7) Mathematical models that show how medicine works in the human body.
- 8) Calculations to predict global warming and so on

Planning and decision-makers can develop cost-efficient management strategies by using mathematical models, which are acknowledged as an excellent tool for examining the economic, environmental, and ecological effects of various pollution control and resource conservation measures.

Symbolic representation of mathematical model [2]:-



Classifications of the models are:

Group of models	Classification	Criterion of classification
I	Mechanistic	Based on mechanism/underlying phenomena
	Empirical	Based on input-output, trials or experiments
II	Stochastic	Contains model elements that are probabilistic nature
	Deterministic	Based on cause effect analysis
III	Lumped parameters	Dependent variables not function of special position
	Distributed parameters	Dependent variables are a function of special
IV	Linear	Super position principle applies
	Nonlinear	Super position principle does not applies
V	Continous	Dependent variables defined over continuous space time
	Discrete	Only defined for discrete values of time/or space
	Hybrid	Containing continuous and discrete behavior

Applications of Mathematical modelling in Sustainable Development

Mathematics is the language which can describe every activity that happens in the world; hence it plays a crucial role in society. Furthermore, any strategy used by humanity to tackle these problems must take into account Mathematics. Equations are used to analyse issues such as climate change, biodiversity preservation, pollution reduction, epidemic control, ocean sustainability, and the prevention of both natural (such as volcanoes, earthquakes, and tsunamis) and man-made (such as fires) disasters. In other words, mathematical science is essential to the sustainability of planet Earth. Differential equations, both linear and nonlinear, are used to study climate change, biodiversity preservation, disease management, and ocean sustainability [3, 5].

The majority of human activity on the globe is supported by Mathematics, which also aids in our understanding of natural processes. Applications of research, graph theory, and number theory can be seen in corporate transactions, the Internet, and transportation networks. Finally, we may bring up its crucial function in education, as language and mathematics serve as the cornerstones of all educational systems. As we can see, Mathematics is essential for the growth of many Earth-related fields of knowledge.

In order to address environmental, development, and sustainability challenges on a worldwide scale, the United Nations Sustainable Development Objectives (SDGs) agenda 2030 has been in place since 2015. It contains 17 goals, 169 targets, and 232 distinct indicators. It is crucial to emphasise that the approach devised depends on scoring interactions between each pair of SDG objectives included in the analysis, according to the authors in [4]. (And, of course, the mathematical machinery used to analyse these interaction scorings, as explained in the article through the Cross-impact matrix).

Now let us understand how Mathematics can help in the 17 SDGs of the 2030 Agenda, It has a lot to do with the work topics of the Mathematics of Planet Earth program:

- A planet to discover, focusing on oceans; meteorology and climate; mantle processes, natural resources and solar systems.
- A planet supporting life, covering issues such as ecology, biodiversity and evolution.
- A planet organized by humans, looking at political, economic, social and financial systems; organization of transport and communications networks; management of resources; and energy.
- A planet at risk, covering climate change, sustainable development, epidemics; invasive species and natural disasters.

The sustainability of the earth is being relied on by society in these crucial years, and mathematics is at the central component of every such problem. The initiative has identified three main issues that mathematicians should strongly address:

- Emphasis on Mathematical research and studies to determine and help with the planet with some potential solutions to support sustainability.
- Preparing and motivating the teachers at every level to educate and spread the importance of Mathematics as a subject.
- Enlightening the common man about the critical role that the subject plays in facing the challenges.

CONCLUSION

With the most critical concern of the ongoing challenge to adapt and live in a sustainable manner on this planet earth, we need to acknowledge the importance of the role of Mathematics and Statistics. The human existence, usage of resources and the extinctions are all quite complex challenges that's the planet is constantly facing. In order to meet the sustainably survive these challenges we need Mathematical models and statistical analysis.

Latest technologies, improved models, and optimizations of existing resources is all possible with the mathematical tools and understanding. As the constant changes or time, requirements etc. can all be taken care of. Practically 17 SDGs of the 2030 Agenda have also stated how Mathematics is very important subject in sustainability and has intrinsic mathematical solutions that pose significant open problems. As a result, it is very important and needed that more mathematical researchers, scientist and educators activity start working on the sustainability research, with good support from governments and leading authorities.

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ON THE PROBLEM OF MODELING SURFACE AND DEEP STRUCTURES OF ENGLISH COMPOUND TERMS OF THE "INFORMATION RETRIEVAL" DOMAIN

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ABSTRACT

For the first time ever there has been used a five-aspect description of the English terms for the "Information retrieval" domain. The volume of the syntactic-semantic feature and the lexical-semantic feature of the term structure is described. There have been discussed difficulties of manual extracting a term from a text (term extraction), of checking a word for terminology, etc. On the basis of a pre-built classification of branch notions there has been a lexico-semantic feature described. There has been introduced "substitute/replacer" concept of a text term as well as it is proposed to take into account the frequency of use of such substitutes when constructing frequency dictionaries.

It is common knowledge that spheres of terminology exploitation are extensive [1; 6-9]. In this case, we have only to point out that multiword terms which express highly specialized concepts are widely used in systems for automatic analysis of research-and-engineering speech, either oral or written. There is a special attention paid to this complex lexical unit. And that is due to the fact that a term, as the most informative text piece, is to be constructed in the most optimal way. Then, with its help it would be possible to more effectively express, say, the meaning of the document and the search query in multilingual search engines as well as to improve machine translation and human-machine interaction. But up to now there has been no proper clarification given in what way the sign is being constructed at the moment of speech. That is why the problem of ordering and normalizing terminologies is still a challenge to be addressed.


To carry out a more thorough modeling of the external and internal structures of the compound term (with left- or right-sided expansion relative to the core of the term, or with both ones), we propose a five-feature compound-modelling. Taking into account the complexity of three-feature modeling, performed in [2], It goes without saying that this five-feature description is even more labor-intensive.


It is necessary to previously frame the content of semantic-syntactic features of the type "instrumentality", "locativity", "place", "time" and other numerous features of the same degree of semantic abstraction, as well as to frame the content of semantic-lexical features of the type "inanimate", "mechanical process", "intellectual process", "community" and other features of this abstraction level.

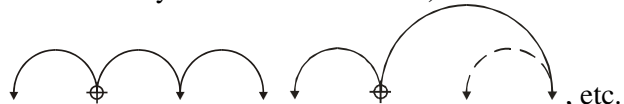
By the notion term we mean "... a word or a phrase (formed on the basis of subordinate relations) that has a professional meaning, expresses and forms a professional concept, which is used in the process of (and for) the cognition and exploration of a certain range of objects and relations between them within the frames of a certain profession." [5, p. 3].

A compound term (let's call it a compound) can have either only a prepositive extension or a postpositive one, or both extensions. In the term structure there are only subordinate relations between term elements [5, p. 3]. The subordinating connection comes from the grammatically main terminological element (let us call it the

core, as it is the centre within a lineally-arranged compound semantic structure). Examples:  (core

controls only one term element), (the case of nested links) , (nesting and the core being

controlled by three term elements) . The following chain options are also possible:

, etc.

To obtain a frequency list of such syntactic chains, one is previously to identify the term scope, i.e. 1) volume of the notion "word", 2) termhood or nontermhood of a given terminological element, i.e. find out whether a given termelement carries some special meaning or not. For example, our analyzer robot (virtual program) is supposed to "understand" the termhood of the "concrete-surfaced" element in the compound "concrete-surfaced

*runway” [3, p. 154], the “four-engined” element in the compound “four-engined *plane”), as well as the termhood of the “first” element in the compound “first space *velocity”. In syntactically similar, as it may seem, phrases like “lady with a dog”, “first digitization program”, our “intelligent” analyzer is supposed to determine the nontermhood, i.e. “understand” that the element “with a dog” and the element “first” do not carry any special/terminological meaning within a particular text part. (See the interpretation of the semantic feature "inalienability" and the use of the predicate notation in [3, pp. 153-154]). Furthermore, prior to entering the next term into the machine array of terms, there is distinction between words indicated within the body of such compounds as H-data , H-bomb, post mortem dump [2, p. 153]. Then compounds take the form “H-#*data, H-#*bomb, “#post mortem# *dump”, where one termelement is separated from the other one by a machine-readable hash sign. As a result, the compounds Hollerite data, hydrogen bomb, post mortem dump are considered ready for machine processing.

Modeling Deep Structure of a Compound

Conditionally constructed model of an English compound can be graphically shown as follows (Fig. 1).

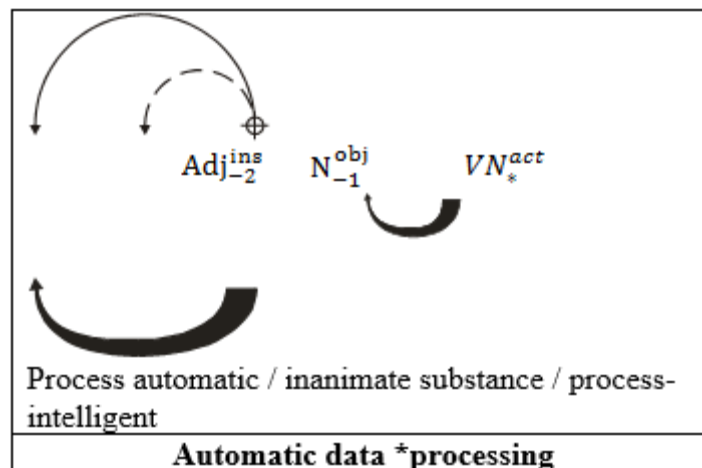


Fig.1: Image of the 5 featured model of the English compound

Let's make some explanations to Figure 1 .

Here, we list 5 features of the model:

- 1) Morphological trait;
- 2) A sign-location of the given thermo-element relative to the compound core;
- 3) Direction of syntactic communication;
- 4) Grammatical and semantic attribute (representative of grammatical semantics);
- 5) lexical-semantic attribute (representative of lexical semantics).

In this form, the model cannot be stored in the memory of a digital computer, because a digital computer can only process digits. In the memory of a digital computer, i.e. in the computer memory, Figure 1 will be presented in the following form:

Table 2: The machine view of the 5 attribute compound model automatic document *processing

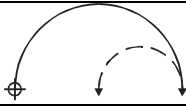
Inanimate thing			Inanimate thing			Mechanical action	
Instrument			Object			Action	
ADJ (adjective)			N (noun)			N (verbal noun)	
-2	*		-1	*		*	*
automatic			document			*processing	
1	2	3	4	5	6	7	8

Identifying syntactic chains in the compound has a real significance, since to a certain extent it surely determines the way of human linguistic behavior, the way of “saying” a thought (A.A. Potebnya) a domain-specific one. When identifying such chains, we are going to have to find out what a “word” is, what a “branch notion” is, and what “termhood” is, i.e. fundamental notions of terminology. Below, we propose a more detailed modeling of the compound, namely, modeling, including its deep structure [4]. Since we consider that

extralinguistic reality is described by only two classes of linguistic meanings, the logical question is: how can a language describe the whole material world with the help of its grammatical meanings and lexical meanings? Such a "weighted" statistical and probabilistic observation of compounds, apparently, can help answer this "how" question. Below, a five-aspect structure of the English compound model is proposed [4].

The Structure of the English Compound Model.

Five aspects/features of the model are stored in sectors 2-6. Sector 1 stores the physical compound, manually extracted from the text and pre-machine edited [2, p. 37-44].

Sector number	content	example
1	Term	knowledge *processing
2	Morphological structure of the English compound	Adj + N + N* automatic term *extraction
3	Positional chain of the English compound	Adj ₋₂ + N ₋₁ + N* automatic term *extraction
4	Syntagmatic chain of the English compound	
5	Syntactic-semantic formula of the English compound	« <i>object+process+actor</i> » data-processing *system
6	Lexico-semantic formula of the English compound	< <i>intellectual process</i> + * inanimate entity > a digitizing *routine

Let us assume that the compound and the model attached to it constitute a transaction. Program access is possible to any sector of the model and the opportunity arises to receive an answer to any search query regarding any linguistic subject - be such a subject as "compound", "term element", "morphological category", "syntactic link", "syntax chain", "sign instrumentalism", sign of "inanimate" or any other various combinations of such objects. Such search queries are organized to an array of transactions recorded in the computer's memory. As a result, we can calculate the total rate of any linguistic subject, as well as the sample rate, average sample rate, and variance. On the basis of the obtained micro-bank of composite terms and terminological elements, it is also possible to study a narrowly specific problem, for example: "How often does instrumentality arise in the first terminology structure preposition if the core is filled with the morphological category of gerund" (this information is also important for teaching English).

Types of transaction requests 1) **The first** group of queries: In the array of compounds, there is to be calculated the frequency of: 1) compounds, 2) term elements, 3) morphological classes, 4) morphological constructions, 5) morphological classes in each position of the compound, 6) morphological classes in each position of the compound, in case the core of the compound is occupied by an English noun or gerund; 7) what is the behavior of morphological categories in the term structure, if the core is occupied by inanimateness/animation/mechanical process/intellectual process/lexical feature "community" (this feature [4] describes the words: planet, state, country, capital, city, institute, research institute, institute sector, team (people), family, conference, front, army, military platoon, etc.; 8) identify the frequency of syntactic chains within the compound [1; 6] and their configuration depending on the content of the nucleus, etc.

2) **The second** group of queries: In the array of compounds, there is to be calculated the frequency of: 9) a feature "instrumentality", "process", "object", "doer", etc.; 10) how often instrumentality occurs in the 1st preposition of the terminology structure, if the core is filled with the morphological category "gerund" (this information is also important for teaching English); 11) other numerous combinations of the above queries.

3) **The third** group of queries: For each linguistic subject 12) there to be calculated the sample frequency, average sample frequency, variance.

In conclusion we should say that man-machine interaction is rather promising research direction.. However, it would be appropriate to recall three rules of such fiction writer as Asimov. These rules regulate man-machine communication. Human brain is antinomic, its work is full of paradoxes, logical errors etc. Nevertheless, there are situations of critical stress, which neither of artificial intelligence can cope with. For example, in warfare situation a human brain starts working at a rate of animal's instinct coupled with human logic. This is a very serious problem situation. And it's not clear, what can result from making specific approaches to its solution.

A computer optimism, specific to the end of 50th-the beginning of 60th years of the last century, was replaced by a pessimism of technological leap in 70 th-90th years. We believe that this situation will continue a while

longer. Full interaction with robots can become really possible. But it's necessary to undertake efforts, not only purely technical.

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FOOT NOTES

- Inanimate entity is the top of some local concept tree.

WOMEN AND ENTREPRENEURSHIP: FACTORS AFFECTING GROWTH OF WOMEN ENTREPRENEURS**Dr. G. Kavitha¹ and Lakshmi Narendran²**¹Assistant Professor, Head of the Department, Department of Commerce²Assistant Professor, Department of Commerce, PSGR Krishnammal College for Women, Coimbatore**ABSTRACT**

Gender issues have been persisting for a long time for entrepreneurs across the globe, so it's only obvious that many studies have been dedicated to learn gender culture and analyse the performance of women in modern business. Today, the number of women undertaking economic activities has increased by many manifolds. The participation of female entrepreneurs are evident at all levels. They make up only a third of the entire entrepreneurial population. However, the role they play is very significant for the socio-economic development. With their participation and contribution, the entire global scenario has changed. The empowerment of women is the core in achieving the objective of inclusive, equitable and sustainable development. This is not just a regional or national objective, but a global agenda. The Vice President of India has emphasised this in the inaugural session of the International Conference on 'Empowering Women: Fostering Entrepreneurship, Innovation and Sustainability'. 1.38 lakh projects have been set up by the women entrepreneurs under Prime Minister's Employment Generation Programme (PMEGP) Scheme since inception and upto 23.01.2019. The projects set up by women entrepreneurs are about 30% of total projects set up under PMEGP. Under the scheme, women entrepreneurs are covered under Special Category and are entitled to 25% and 35% subsidies for the project set up in urban and rural areas respectively. Currently women entrepreneurs maybe less but overall women comprise about 30% of corporate senior management positions, which is notably higher than the global average (24 percent). The overall median proportion of female executives in successful companies is 7.1 percent, compared to 3.1 percent at unsuccessful companies. Stand-Up India facilitates Bank loans between 10 lacs to 1 Cr to SC/ST & or women entrepreneurs

Keywords: gender culture, inclusive, equitable, sustainable development, Fostering Entrepreneurship, PMEGP, Stand-Up India

INTRODUCTION

The business world is volatile and subject to sensitivity. This pushes the entrepreneurs to take measures to keep sustaining and growing. Cultural and societal influence has seen men dominate the entrepreneurial domain. But this situation is seeing some big changes now.

Although this change has been happening, it is slow and the results are not balanced. The statistics show a lopsided result for the number of lady-entrepreneurs and professional leaders. This is also a reason why there is a belief that male entrepreneurs are more successful than their female counterparts.

Entrepreneurship and Gender: Researchers' perspective

Gender issues have been persisting for a long time for entrepreneurs across the globe, so it's only obvious that many studies have been dedicated to analyse the performance of women in modern business. Implicitly it may look like men dominate the entrepreneurial area, a surprising fact is that there are many traits where women outshine their male colleagues.

The world shows a wide range of economies and stages of women's entrepreneurship, from best performing to those in incubation stages of economic development. This study aims to offer different aspects for women's entrepreneurship, evidenced by the rates of entrepreneurial activities and motivations and key factors that characterize the business and environmental conditions

REVIEW OF LITERATURE

According to Chinmayee Sahoo (2020) Women Entrepreneurship in India: An Insight into Problems, Prospects and Development, International Journal of Engineering Research & Technology, Overall development cannot happen without the upliftment of women who constitute who is about 50 percent of the total population. So, their contribution is essential and inevitable for healthy nation building. Women entrepreneurs have been making an impact in the economy which is more than 25% of all kinds of business. Women entrepreneurship must be developed and honed properly with entrepreneurial qualities and skills to adapt to the latest trends, challenges of the world markets and also be self sufficient enough to sustain and strive for excellence.

According to Shiny Chakraborty and Rhitabrita Mukherjee (2019) Women's Entrepreneurship in India, ISST and IWWAGE Position Paper, there is a clear demarcation between women's self-employment and wage

employment. Self employment must not be considered same as entrepreneurship. In India, as in other developing nations, female led ventures need to be encouraged more. Suggestions towards betterment of women entrepreneurship, schemes and steps for the same have been discussed.

Mayank Mishra and Nikhil Iyer (2021) in the paper titled “Towards a gender-responsive and inclusive economic recovery for India in the COVID-19 context” identifies solutions and suggestions for a gender-responsive and inclusive India. They have also studied the impact of gender culture on entrepreneurship.

GENDER CULTURE AND ENTREPRENEURSHIP: GROWTH FACTORS OF WOMEN ENTREPRENEURSHIP

Women Entrepreneurship is the process of business ownership and business creation that empowers women economically, increases their economic backing and status in society. In India Entrepreneurship is very limited amongst women especially in the formal sector, which is less than 5% of all the business. Women entrepreneurs are not researched as much as they ought to be. The lack of knowledge of the important sector of our demography creates a blind spot.

Today, the number of women undertaking economic activities has increased by many manifolds. The participation of female entrepreneurs are evident at all levels. They make up only a third of the entire entrepreneurial population. However, the role they play is very significant for the socio-economic development. With their participation and contribution, the entire global scenario has changed. The contribution of women in the area of entrepreneurship can be positively correlated to mobilizing the idle saving of the public productively, creating channels of employment so as to make them financially independent, promotion of overall development in a balanced way, tapping of unutilised capital and skill and promote global development.

Women and Entrepreneurship

A woman entrepreneur is one who manages the business of enterprise single handedly or as a group. She undertakes the planning, execution, supervision and control. Studies have shown that women take calculated risk. The skill of building a sound organization is required for industrial development. A woman entrepreneur undertakes all the activities from conception to follow up, simultaneously managing all the resources as well. Inner virtues, both inherited and developed, are required for the success of a women entrepreneur.

Inherently, women entrepreneurs face the adversities with a lot of grit and courage. With faith, she attempts to solve the problems even under situations of pressure. Supplementing this, with good leadership skills, she can influence and support others to work enthusiastically towards achieving objectives.

Women- Flag Bearers of Change

Gone are the days when women would end up their entire life within the 4 walls of the house. Like the male counterparts, women nowadays are writing fresh stories of unprecedented success, with their wit and hard work. More and more women are expanding their entrepreneurial horizons and venturing into an unprecedented range of business areas. The greater choices now available to women in the fields of employment has been the major driving force for their upheaval as bureaucrats, professionals and executives. They have now begun to enter the fiercely competitive world of business - and economic independence. The fact that such a large percentage of them had entered the non-traditional areas attests to female entrepreneurship being a fairly recent phenomenon boosted by programmes and schemes of Indian Govt aimed at reinstating women empowerment in the long run. The Traditional female skills are being turned into a livelihood, by starting a home based business encompassing textiles, catering, embroideries, boutiques, crafts and many more. Look at the world around you that women are empowered is evidence by their prevailing presence in courts and public offices, corporate houses and parliament, and what not.

Factors Motivating Women to Start Businesses or Join Workforce

Women entrepreneurs are empowering 50% of India's start-up ecosystem, driven by:

- **Recognition:** Recognition in the form of admiration, regard, esteem and renown motivates women entrepreneurs. According to a survey by Bain & Company, more than 45% of Indian women in rural areas were driven to start a business for gaining recognition.
- **Results:** Women-led start-ups provide 35% higher ROI compared to those led by men. This ability to generate more returns is what drives women to begin their own venture.
- **Fulfilling unsatisfied needs:** The inherent need in women to be an equal contributor or primary provider of the family is a key factor. As they make 85% of purchase decisions, the need to provide a better lifestyle motivates women.

- **Education:** India ranks among the top worldwide for producing female graduates in the science, technology, engineering and mathematics (STEM) industry, with as many as 40% of women graduating from this field.

Growth and sustenance of Women Entrepreneurship

Globally, economies are classified into developed economy, developing economy and underdeveloped economy. As per statistics it is known that in well-developed economy women are provided with a platform to develop as an entrepreneur, with equal priority as their male counterparts. Whereas in developing and under developed economies women have different set of challenges despite have a lot of schemes for their development.

Women are growing well day by day with their contributions shining as scientists, software engineers, technocrats, economists, professors, lawyers, doctors and as entrepreneurs too..

As per the Sixth Economic Census released by the Ministry of Statistics and Programme Implementation, India, Women form around 14% of the total entrepreneurship i.e. 8.05 million out of the total 58.5 million entrepreneurs in the country. Out of this, 2.76 million women that are 13.3% of total women entrepreneurs are in the agriculture sector whereas 5.29 million women that is more than 65% work in the non-agriculture sector. The average employment in women-owned enterprises is meagre 1.67.

The empowerment of women is the core in achieving the objective of inclusive, equitable and sustainable development. This is not just a regional or national objective, but a global agenda. The Vice President of India has emphasised this in the inaugural session of the International Conference on 'Empowering Women: Fostering Entrepreneurship, Innovation and Sustainability'.

A recent World Bank report has revealed that there is a tendency for women employers to hire mostly women. This may be partly because of the inherent nature of the kind of businesses set up by women entrepreneurs, which could be tailoring units, beauty and wellness saloon, etc. In this the employment offered is to a few women per unit. Thus the findings is that a large number of women entrepreneurs are micro-household enterprises supplementing their family income by making a contribution.

There is no doubt that if given the right opportunities and proper surrounding for growth, women have the skills to excel in different spheres of business and have proved so. Suitable conditions need to be created to facilitate and encourage women to have full, active and unhindered participation in social, economic, political and public life so that their potential is realized fully for the benefit of the society.

Lack of equal access to education & employment, inequalities in the labour market, rising sexual violence and unequal division of unpaid care and domestic work remain the key barriers to their advancement. Such disparities must not hinder their growth. A major shift in mindset would lead to a positive attitude towards women and their role in society. Women's active participation in decision-making has a positive impact on education, health, nutrition, employment and social protection. Women's empowerment has a multiplier effect not only on their own lives but also on the family and the society

International Women's Day, celebrated on the 8th of March every year, is a vital point in the movement for women's rights. It is a day when women are celebrated across various divisions, whether national, ethnic, linguistic, cultural, economic or political. The empowerment of women continues to be a central feature in an effort to address social, economic and political challenges across the globe. To celebrate this gracious occasion and celebrate the spirit of Women Entrepreneurship, Startup India is engaging in multiple activities to support early stage women startups and aspiring entrepreneurs.

Thinking Ahead- connecting Skill to Industry

Ministry of MSME, which currently hosted its first Conclave on Empowering Women Entrepreneurs of marginalised Sections' received colossal applications – has emerged as the flagship institution serving as a response to the arena of female entrepreneurship. Focused at highlighting the issues of hidden disparities and discuss a range issues to bring to limelight the ever evolving role of women entrepreneurship in India, the conclave showcased multiple sessions wherein achievers from various walks of life came together to discuss and ponder upon on key issues. The conclave was a huge success amongst SC/ST women entrepreneurs. The Ministry also awarded path breaking women entrepreneurs and outstanding women achievers in varied fields who have broken the stereotypical shackles. This aims to celebrate women who are breaking the regressive chains that society and circumstance have placed on them, and are choosing to be financially independent, while continuing in their traditional roles as primary caregivers.

MSME- Transforming Homemaker to Entrepreneur

Women are the pillars of society and when women are empowered, the whole world is empowered. Ministry of Micro, Small and Medium Enterprises (MSME) is empowering women entrepreneurs through its different schemes helping women spark their talent and build their own identity. 1.38 lakh projects have been set up by the women entrepreneurs under Prime Minister's Employment Generation Programme (PMEGP) Scheme since inception and upto 23.01.2019. The projects set up by women entrepreneurs are about 30% of total projects set up under PMEGP. Under the scheme, women entrepreneurs are covered under Special Category and are entitled to 25% and 35% subsidies for the project set up in urban and rural areas respectively. For women beneficiaries, own contribution is only 5% of the project cost while for general category it is 10%. During the last 5 years, under the Khadi Programme of KVIC, women entrepreneurs have set up 30437 projects. Toward these projects, fund allocation of 85,305 lakh Rupees have been channelised.

Not only MSME, the Government of India has also taken various actions and productive steps towards women empowerment and safety. Stand Up India, Beti Bachao, Beti Padhao, Mahila Udyam Nidhi Scheme, Mudra Yojana Scheme, Udyogini Scheme, TREAD (Trade Related Entrepreneurship Assistance and Development) Scheme, Annapurna Scheme, Stree Shakti Package for Women Entrepreneurs, Mission Indradhanush, Bhartiya Mahila Business Bank Loan, Dena Shakti Scheme, Cent Kalyani Scheme are the various schemes offered by the government of India

Government Initiatives to Encourage Women Participation

The Indian government has raised the budget for Women and Child Development by 14% in 2021 and set aside over Rs. 30,000 crores (US\$ 3.97 billion) in FY21. This allocation also includes various development schemes in the budget as listed below.

• Udyogini Scheme

This scheme is for women who has an annual income of Rs. 1.5 lakh (US\$ 1,985). It provides loans of up to Rs. 3 lakh (US\$ 3,890) for women who want to start a business but have no access to capital sources

• Bharatiya Mahila Bank Business Loan

This type of business loan was set up in 2017 to help women get cheap loans and aspire big despite their lack of resources. The scheme offers loans of over Rs. 20 crores for women entrepreneurs. A collateral-free loan can also be taken for loans worth less than Rs. 1 crore.

• Pradhan Mantri Mudra Yojana

This is a generic scheme launched for the benefit of all. However, women seem to enjoy the benefits of this scheme. This helps anyone looking to set up a micro/small enterprise to avail an institutional credit of up to Rs. 10 lakhs .

• Women Entrepreneurship Platform

NITI Aayog launched this is a flagship platform to promote women entrepreneurship. The platform conducts various workshops and educational events to drive women to start their own business.

• Free Co-Working Space

Startup India in collaboration with select organizations across India, provides free co-working space for startups led by women entrepreneurs. These startups will be able to work in a collaborative, inclusive and flexible environment based on mutual trust between the organizations and entrepreneurs.

• Speed Mentoring

As a way to provide instant and effective mentorship to aspiring women entrepreneurs, Startup India is organizing a Speed Mentoring session. Various panels will be set up and each panel will consist of 4 eminent women personalities:

- An Investor
- A Government/Industry Official
- A Successful Woman Entrepreneur and
- A Legal Specialist.

The entrepreneur who is shortlisted will receive an opportunity to utilise 10 minutes with each stakeholder in the panel, hence receiving 40 minutes of dedicated and focused interaction and with the panelists. The purpose of this interaction is to enable these entrepreneurs to polish their own skills and strategies and take their ideas to the next level.

Key Insights on the Loans Disbursed to Shgs

The central government released INR 1,625 crore for women entrepreneurs and also declared that the loan limit for SHGs has been raised from INR 10 lakh to INR 20 lakh in August 2021. The Status of Microfinance Report (2020-21) published by the National Bank for Agriculture and Rural Development (NABARD) reports that savings of nearly 70 lakh SHGs (7.5 crore families) out of 112.2 lakh SHGs, touched an all-time high of INR 37,478 crore and the banks have disbursed loans of INR 58,071 crore by March 2021. Around 68.5% of total SHGs are located in South and Eastern regions contributing 81.2% of total SHGs' savings. They get 93.6% of total credits extended to SHGs with a good credit quality with Non-Performing Assets (NPA) to total loans ratio less than 5%, while a few other regions have NPA ratios more than 40%.

Aided by these policies, businesses owned by Indian women entrepreneurs are likely to see a growth of 90% in the next five years. Another report by Bain and Co. and Google titled- Women Entrepreneurship in India—Powering the economy with her, established that **Women Entrepreneurs in India** can churn out 150-170 million jobs by 2030.

Key Insights from the E-Shram Portal

- 19 52.65% of the 14.40 crore unorganised sector workers registered are women
- 10.28% of registered workers are employed as domestic and household workers
- 6.4% of registered workers are employed in apparel which tends to have more women workers 10.9% registered workers are employed
- 10% of Indian startup unicorns are women-led
- 20.37% of women are MSME owners, which account for 23.3% of the labour force
- Women-led startups provide a 35% higher return on investment compared to those led by men
- 10-15% of tech startups have at least one-woman founder/co-founder

Reportedly, the number of women-owned enterprises in India is higher than many other countries, with them owning an estimated 13.5 million to 15.7 million MSMEs and agribusinesses. However, most of these enterprises are largely single-person enterprises, with only 17% of all women-owned enterprises employing hired workers versus 28% for all enterprises.

Women Entrepreneurship and Economic Development

Women entrepreneurs around the globe have significant impact on the economic development, as the entrepreneurial ventures are creating new employment opportunities (Akehurst *et al.*, 2012). Because of the rising number of women entrepreneurs who are contributors of the economy, more and more scholars are focusing on women entrepreneurship in recent years (Bullough *et al.*, 2015; Faisal *et al.*, 2017). Nafukho *et al.* (2004) emphasized the prominence of human resources which is a major factor of economic development and ensures a positive factor of its growth. The proper utilization of manpower enabled the growth but in least developed countries major portion of women workforce is either untapped or unnoticed which can be a hindrance of development. This barrier can be faced with the encouragement and providing channels or arenas to women to setup their own independent businesses (Vinay and Singh, 2015).

Women constitute only 13.76% of the total entrepreneurs, i.e., 8.05 million out of the 58.5 million entrepreneurs.

These establishments in total, owned by females, provide employment to 13.45 million people

Currently women entrepreneurs maybe less but overall women comprise about 30% of corporate senior management positions, which is notably higher than the global average (24 percent)

The overall median proportion of female executives in successful companies is 7.1 percent, compared to 3.1 percent at unsuccessful companies

Stand-Up India facilitates Bank loans between 10 lacs to 1 Cr to SC/ST & or women entrepreneurs

Trade Related Entrepreneurship Assistance and Development (TREAD) provides women with trade related training, information and counselling & grant of up to 30% of the total project cost.

CONCLUSION

Studies have been analysed and gone through for the purpose of preparing this paper. We can see the enhancement in the support system to the women entrepreneurs has increased by a huge margin, be in qualitative or quantitative support. Funds have been allocated for their upliftment and attempts have been to channelise these funds to be utilised in fruitful ways. Inclusion in a sustainable way has been put into practice by bringing up the under privileged sector. For this purpose trainings have been given to the women thereby developing their skills. These skills can then be used towards income generating activities. The facts stated also speak of the growth rate in women entrepreneurs. The future looks promising with this trend only having a way forward thereby bringing in more aspirants to be financially independent and unleash their entrepreneurial skills.

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PHLEBOTOMY: BEST CLINICAL PRACTICES**Dr. Shashi Dhar Mehta¹ and Sandhya S. Mehta²**¹Department of Pathology, Laboratory Diagnostic Services, Vallabhbhai Patel Chest Institute, University of Delhi, Delhi, India²Department of Microbiology, State Reference Laboratory (HIV Lab.) Lady Harding Medical College & S K Hospital, New Delhi, India**ABSTRACT**

Phlebotomy is both a science and an art. It's the science of drawing blood and the art of locating the vein correctly and causing minimum pain to the subject in the process.

The venipuncture procedure is complex, requiring both knowledge and skill to perform.

The performance of routine vascular access procedures by skilled phlebotomists requires, at a minimum, the use of gloves to prevent contact with blood. Each phlebotomist generally establishes a routine that is comfortable for her or him.

Phlebotomy techniques programme are conducted with the goal to standardize the clinical practice and educate prospective phlebotomists on health and safety best practices.

The phlebotomist is one of the first persons an anxious patient meets. The phlebotomy Technologist handles patients with good people skills, makes them feel relaxed, and ensures that the procedure is done quickly & easily.

Now days, the Allied Healthcare industry is booming with high career prospects of the Phlebotomists.

Keywords: Venipuncture, Anticoagulant, Tourniquet, Gauge, Order of draw, Hematoma, Contamination, Phlebotomist.

INTRODUCTION

Phlebotomy (the drawing of blood) has been practised for centuries and is still one of the most common invasive procedures in health care. Each step in the process of phlebotomy affects the quality of the specimen and is thus important for preventing laboratory error, patient injury and even death of the patient. For example, the touch of a finger to verify the location of a vein before insertion of the needle increases the chance that a specimen will be contaminated. This can cause false blood culture results, prolong hospitalization, delay diagnosis and cause unnecessary use of antibiotics. Jostling and jarring of test tubes in transit can lyse or break open red blood cells, causing false laboratory results. Clerical errors in completing forms and identifying patients are common, costly and preventable. Other adverse effects for patients are common; they include bruising at the site of puncture, fainting, nerve damage and haematomas. These WHO guidelines outline the simple but important steps that can make phlebotomy safer for patients.

Phlebotomy also poses risks for health workers. It is still common to see phlebotomist carryout dangerous practices known to increase the risk of needle-stick injury and transmission of disease.

Dangerous practices include:

- recapping used needles using two hands;
- recapping and disassembling vacuum-containing tubes and holders;
- reusing tourniquets and vacuum-tube holders that may be contaminated with bacteria and Sometimes blood;
- working alone with confused or disoriented patients who may move unexpectedly, Contributing to needle-sticks.

Phlebotomy involves the use of large, hollow needles that have been in a blood vessel. The needles can carry a large volume of blood that, in the event of an accidental puncture, may be more likely to transmit disease than other sharps. Bloodborne organisms that have been transmitted after needle-sticks include viruses such as hepatitis B and human immunodeficiency virus (HIV), bacteria such as syphilis and parasites such as malaria.

OBJECTIVES

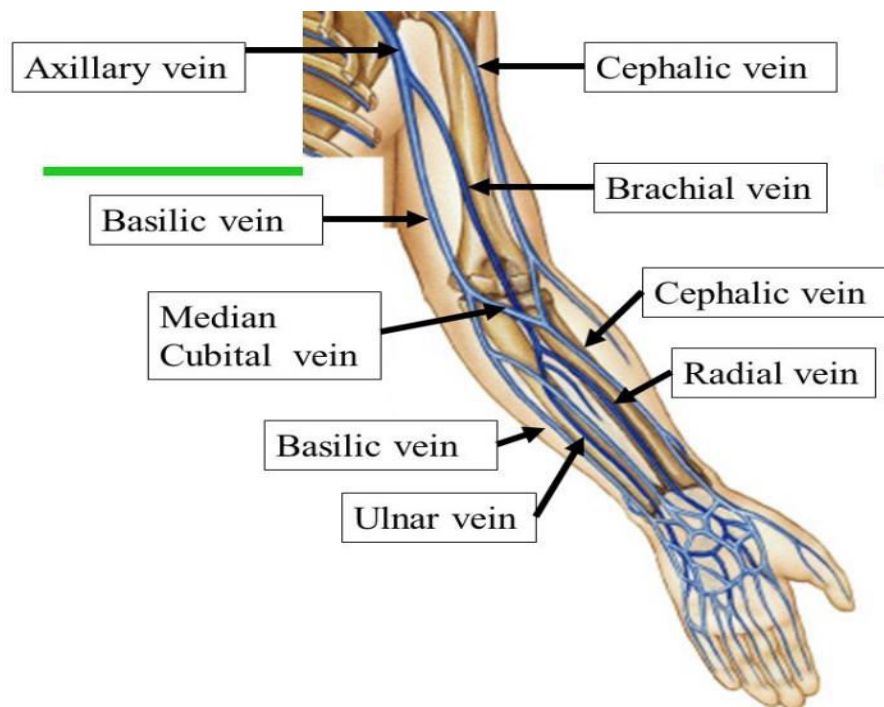
The objectives of these guidelines are to:

- improve knowledge and awareness of the risks associated with phlebotomy among all health workers / Medical Technologist involved in the practice;

- increase safe practices and reduce bloodborne virus exposure and transmission;
- improve patient confidence and comfort;
- improve the quality of laboratory tests.

Protecting Patients:-

To reduce the risk of adverse effects for patients, health workers undertaking phlebotomy need to be trained in procedures specific to the types of specimen they collect. Such procedures may include arterial sampling, capillary sampling, blood culture collection and venous blood draws. Health workers who collect specimens from children and infants will need special training and practice for these procedures. Phlebotomists working in settings with more technology may be trained in techniques for plasma and red cell exchange, photopheresis, stem cell collection and cord blood collection. Health workers may need to collect specimens from in-dwelling central lines or arterial lines. Training should include techniques that ensure that the specimen collected will be adequate, and measures that reduce the risk of contamination, clerical error, infection and injury. When taking blood, health workers should wear well-fitting, non-sterile gloves, and should also carry out hand hygiene before and after each patient procedure, before putting on gloves and after removing them. The blood should be taken in a dedicated location that ensures patient comfort and privacy. To remove the risk of environmental contamination with pathogens, counter and work surfaces, and chair arms should be cleaned with disinfectant at the start of each shift and when visibly dirty. To prevent infections and other adverse effects, health workers should follow the guidelines on patient identification, hand hygiene, use of gloves, skin disinfection, use of appropriate blood-sampling devices and safe transportation of laboratory samples.



Patient consent and cooperation are important components of respecting patient rights.

A patient information leaflet or poster that explains the procedure in simple terms is helpful.

PROTECTING PHLEBOTOMISTS

Best practices in phlebotomy protect health workers as well as patients. One way to reduce accidental injury and blood exposure among health workers is to use safety (i.e. engineered) devices such as retractable lancets, syringes with needle covers or retractable needles and, when appropriate, plastic laboratory tubes. Another approach is to eliminate two-handed needle recapping and manual device disassembly, and instead dispose of the sharps into a puncture resistant sharps container (i.e. a safety container) immediately after use.

The best practice is to discard the needle and syringe, or needle and tube holder, as a single unit, into a sharps container that is clearly visible and within arm's reach. The size of the container should permit disposal of the entire device rather than just the needle.

Institutions should conduct surveillance on sharps injuries and accidental exposure to blood, so that preventable factors can be identified.



Support services should also be available for healthworkers accidentally exposed to blood. These should include immunization with hepatitis B before assuming duties that include potential exposure to blood and body fluids, and post exposure prophylaxis for HIV and hepatitis B. All health-care facilities should display clear instructions for procedures to follow in case of accidental exposure to blood and body fluids.

These guidelines also outline the responsibilities of managerial staff, including provision of:

- Gloves in multiple sizes, single-use disposable needles, and syringes or lancing devices in sufficient numbers to ensure that each patient has a sterile needle and collection device or equivalent for each blood sampling;
- Sufficient laboratory sample tubes to prevent reuse and manual washing.

If a blood sample is poorly collected, the results may be inaccurate and misleading to the clinician, and the patient may have to undergo the inconvenience of repeat testing. The three major issues resulting from errors in collection are haemolysis, contamination and inaccurate labelling.

Factors that increase the risk of haemolysis include:

- Use of a needle of too small a gauge (23 or under), or too large a gauge for the vessel;
- pressing the syringe plunger to force the blood into a tube, thus increasing the shear force on the red blood cells;
- drawing blood specimens from an intravenous or central line;
- underfilling a tube so that the ratio of anticoagulant to blood is greater than 1:9;
- reusing tubes that have been refilled by hand with inappropriate amounts of anticoagulants;
- mixing a tube too vigorously;
- failing to let alcohol or disinfectant dry;
- using too great a vacuum; for example, using too large a tube for a paediatric patient, or

using too large a syringe (10–20 ml). Serious adverse events linked with phlebotomy are rare, but may include loss of consciousness with tonic clonic seizures. Less severe events include pain at the site of venepuncture, anxiety and fainting. The best documented adverse events are in blood transfusion services, where poor venepuncture practice or anatomical abnormality has resulted in bruising, haematoma and injury to anatomical structures in the vicinity of the needle entry. For example, one study reported bruising and haematoma at the venepuncture site in 12.3% of blood donors. Nerve injury and damage to adjacent anatomical structures occurred infrequently, and syncope occurred in less than 1% of individuals. Vasovagal attacks occurred occasionally, varying from mild to severe; fainting was reported in 5.3% of cases and usually occurred in first-time female blood donors.

Injuries from sharps (i.e. items such as needles that have corners, edges or projections capable of cutting or piercing the skin) commonly occur between the use and disposal of a needle or similar device. One way to reduce accidental injury and blood exposure among health workers is to replace devices with safety (i.e. engineered) devices. Safety devices can avoid up to 75% of percutaneous injuries; however, if they are disassembled or manually recapped, or if the needle safety feature is not activated, exposure to blood becomes

more likely. Eliminating needle recapping and instead immediately disposing of the sharp into a puncture-resistant sharps container (i.e. a safety container) markedly reduces needle-stick injuries. Reporting of accidental exposure to blood and body fluids is more frequent from well-established health-care systems; however, it is thought that the incidence of such exposures is actually higher in systems that are not so well equipped. Home-based care is a growing component of health delivery, and current global trends suggest that home-based phlebotomy will become increasingly common. In this situation, stronger protection of community-based health workers and the community will be needed. This can be achieved by improving sharps disposal, and by using safety needles with needle covers or retractable needles to minimize the risk of exposure to needles and lancets.

Guideline for Training

Phlebotomy practice varies among health-care personnel, even though perceptions of risk are similar and there are guidelines for such practice. To help standardize practice, several

Countries have established formal training that phlebotomists must undertake before they can practice clinically, but physicians can often practice phlebotomy without formal training. During phlebotomy procedures, the greatest concern is the safety of health workers and patients; therefore, guidance for staff on best practice is critical. Training on, and adherence to, the guidance presented here should substantially reduce the risks to both patients and staff, and will improve blood collection for laboratory tests and from blood donors.

The most common use of blood sampling is for laboratory tests for clinical management and Health assessment.

Specialist training include:

- Arterial blood gases for patients on mechanical ventilation, to monitor blood oxygenation;
- Neonatal and paediatric blood sampling
- * Heel-prick (i.e. capillary sampling);
- * scalp veins in paediatrics; capillary sampling (i.e. finger or heel-pricks or, rarely, an ear lobe puncture) for analysis of capillary blood specimens for all ages; examples include testing of iron levels before blood donation, blood glucose monitoring, and rapid tests for HIV, malaria and syphilis.

Benefits of Phlebotomy

Best Clinical practices in phlebotomy involve the following factors:

- Planning ahead;
- Using an appropriate location;
- Quality control;
- Standards for quality care for patients and health workers, including
 - availability of appropriate supplies and protective equipment;
 - availability of post-exposure prophylaxis (PEP);
 - avoidance of contaminated phlebotomy equipment;
 - appropriate training in phlebotomy;
 - cooperation on the part of patients;
- Quality of laboratory sampling.

Quality assurance is an essential part of best clinical practice in infection prevention and control. In phlebotomy, it helps to minimize the chance of a mishap.

Avoidance of Contaminated Phlebotomy Equipment

Tourniquets are a potential source of methicillin-resistant *Staphylococcus aureus* (MRSA), with up to 25% of tourniquets contaminated through lack of hand hygiene on the part of the phlebotomist or reuse of contaminated tourniquets. In addition, reusable finger-prick devices and related point-of-care testing devices

There are two types of systems:

- Open systems and
- Closed Systems

Adverse Effects

Haematoma (2-3%)

Vasovagal reaction / Faint (1%)

Delayed Faint / Syncope (1 in 10000)

Arterial Puncture (1 in 50000)

Nerve damage

Prevention

Clean, non-sterile examination gloves in multiple sizes should be available for personnel who carry out phlebotomy. It is recommended that:

- Well-fitting gloves are worn for each procedure, irrespective of the site of blood sampling or the status of the patient; these gloves can be latex or latex-free, and should be non-sterile (i.e. examination gloves);
- The gloves are changed between patients;
- Masks, visors and eye protection may also be needed if additional blood exposure is anticipated; for example, during arterial blood sampling

Training:

Regular in-service training and supportive supervision should be provided.

- The training programme should provide theoretical and practical knowledge in blood sampling and blood drawing.
- A certificate of competence should be issued upon successful demonstration of phlebotomy after completion of the training programme

SOP Message

Education and training is necessary for all staff carrying out phlebotomy. It should include an understanding of anatomy, awareness of the risks from blood exposure, and the consequences of poor infection prevention and control.

Standard operating procedures (SOPs)

SOPs are required for each and every step or procedure in their Lab.

Making safe transportation of blood or blood products part of best practices will improve the quality of results from laboratory testing.

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AN EVALUATION OF SOME TRADITIONAL HERBAL PLANTS USED IN MANAGEMENT OF MEMBRANE DISEASES

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ABSTRACT

Herbal treatments are becoming increasingly popular, and are often used for dermatological conditions. Thus dermatologists should know about their potential to cause adverse events. This review is aimed at addressing this area in a semi-systematic fashion. Some agents, particularly Chinese herbal creams, have been shown repeatedly to be adulterated with corticosteroids. Virtually all herbal remedies can cause allergic reactions and several can be responsible for photosensitization. Some herbal medicines, in particular Ayurvedic remedies, contain arsenic or mercury that can produce typical skin lesions. Other popular remedies that can cause dermatological side-effects include St John's Wort, kava, aloe vera, eucalyptus, camphor, henna and yohimbine. Finally, there are some herbal treatments used specifically for dermatological conditions, e.g. Chinese oral herbal remedies for atopic eczema, which have the potential to cause systemic adverse effects. It is concluded that adverse effects of herbal medicines are an important although mistreated subject in dermatology, which deserves further systematic investigation.

Keywords: skin lesion, eczema, and dermatology, herbal.

INTRODUCTION

Modern dermatologists have very refined diagnostic and morphological testing methods at their disposal. None the less, it is impressive that experienced dermatologists can frequently establish the diagnosis without any technical aids. Despite the vast body of knowledge, the rapid development of synthetic drug treatment seem to have passed over dermatology, as opposed to cardiology and gastroenterology. Generally, speaking synthetic drugs, such as glucocorticoids, antibiotics, and antimycotics, provide only symptomatic treatment of dermatologic disease. The additional therapeutic possibilities provided by phytotherapy should, therefore, be welcome addition. The interest of dermatologists in herbal drugs has indeed increased in the past few years. In spite of this, many of them lack the patience needed so achieve the desired treatment results. Herbal drugs must sometimes be administered for an extended period of time in order satisfactorily treat and, if possible, to cure skin disease. More and more physicians resort to cortisone-based ointments for quick symptomatic relief. It seems that many of these individuals will generally have to do some rethinking.¹

The skin is a central organ of the human body with a surface area of around 2m² and a weight of nearly 4 kg. It is one of the largest organ systems and one of the most diverse. The skin has sensory and metabolic functions. We use the skin to communicate with or separate ourselves from the environment. The psychosomatic aspect of the skin as an organ also has interesting implications for a number of diseases. The disfiguring effect of many eczematous diseases affects not only the body, but also the psyche, and both are in constant interplay during the course of chronic skin disease. Clear, healthy, and beautiful skin plays a decisive role in the sense of well-being and self-views of the individual.

Everybody wants to look beautiful. The modern world even children are also not in exception. The desire reaches at peak when an individual enters into adolescent stage. Since the time immortal there are three basic needs of a man, e.g., food, shelter and health. Plants actively participated whenever required for the above purposes. After fulfilling the basic requirements the man became conscious for his outer look. The desire to look beautiful is human weakness and is as old as the origin of human being himself.

MATERIAL AND METHODS

Objectives - To describe the various uses for hypnosis as an alternative or complementary therapy in dermatologic practice.

The experiences gathered over centuries went on accumulating and now cosmetology is well defined science itself. Cosmetics are (lie substances specially prepared to enhance beauty and increase the attractiveness of a person. Since ancient times the concept of Solah shringar is common. It means there are 16 ways to beautify the body, i.e... Lips, cheeks, hairs, palms and knees etc.

There are two types of preparation available in the market:

- (1) **Synthetic Cosmetics:** Cosmetics prepared from the synthetic chemicals of compounds.
- (2) **Herbal Cosmetics:** Cosmetics prepared from the plant and other natural drugs like animals and minerals etc.

Skin Diseases Causes Herbal Remedies:-

The first important factor for good looking is the skin. The quality of skin determines the quality of health also. Skin place a very important role in beautification of the body- In addition to this, outer covering of the body protects the body from many damaging factor which may be harmful for the texture of the skin. Some of these are following:

- (a) Attack of microorganisms
- (b) Effect of harmful Chemicals
- (c) Shock
- (d) Temperature
- (e) Excessive loss of water
- (f) Ultraviolet rays

Topical Formulations

Preparations for application to the skin include creams, ointments, pastes, gels, collodions, paints, lotions and applications. These terms tend to be employed rather loosely, but they do have correct meanings. It may benefit sufferers from dermatological problems to be able to distinguish between different types of formulation and to know what they contain: in some cases, cream bases are active themselves (for instance as soothing agents), or they may be vehicles for delivery through the skin of other active substances.

Creams are slightly sticky semi-solids which contain water. They are easy to apply and 'vanish' after application. Creams are administered v/hen it is unnecessary or undesirable to occlude the skin. They are usually based on such ingredients as lanolin, bees' wax and paraffin.

Ointments are distinguishable from creams in being more viscous: often they do not contain water. Their consistency is such that they can be readily applied to the affected area. The relative difficulty in washing them off may be important in allowing active constituents to be absorbed through the skin or indeed to afford protection to it. Ointment bases include waxes, oils and fats.

Pastes are similar to ointments but have a stiffer consistency.

Gels dry on the skin to form a transparent film.

Collodions are liquid and generally alcohol-based this makes them inflammable.

Paints are concentrated liquids which are applied to small areas of skin F with a brush.

Lotions are also liquid: they dry quickly to cool the skin and keep it moist. They too may be flammable.

Skin disorders - Eczema & Psoriasis, furuncles, neuro-dermatitis, itching, Scabies, Warts, Hair loss, vitiligo, lymhpoderma.

Plant used in Psoriasis

Plant used in Acne

Sr No	Common Name	Botanical Name	Family	Method Of Use
1	Alwa	Aloe vera	Liliaceae	Leaf juice is applied exteranally
2	Medar	Calotropis	Ascelpediacea	Leaf exudates studate is applied
3	Chakunda	Cassi tora	Leguminosae	Leaves & seeds powder is applied
4	Somraj	Centratherum	Compositae	externally with milk
5	Kanduri	Anthelmentacum	Cucurbitaceae	Equal parts of seed black pepper&
6	Hul Kush	Coccinia indica	Lamiaceae	sesamum is powdered taken
7	Marking nut	Leucas aspera	Anacardiaceae	Leaves paste is applied Exteranally
		Semecarpus		Pericarp juice is appliedExteranally
		Anacardium		Pericarp juice is applied withGhee

Sr No	Common Name	Botanical Name	Family	Method Of Use
1	Kattha	Acacia sativum	Leguminosae	Heart wood is applied on Affected parts
2	Garlic Arhar	Allium sativum	Lilaceae	Juice is applied on affected part
3	Calendula Lemon	Cajaniis cajan	Leguminosae	Paste of juice is applied
4	Jangli haldi Tesu	C. officiialis Citrus	Compositae	Flower extract is applied
5	Kapas Levander	lemon	Rutaccae	Lemon oil is applied
6	Babhuna	Curcuma aromalica	Zingiberaceae	Rhizome paste is applied
7	Gule –abbas Sandai	Butea frondasa	Leguminosae	Flower extract is applied
8	Methi khaskhas	Hedychium spicatum	Zingiberaceae	Seed paste is applied
9		Levendula vera	Laminaccae	Volatile oil leaves is applied
10		Matricaria Mimhilis	Asteraccae	Flower paste is applied
11		jaiapa Santalum album	Nyclaiginacea	Volatile oil is applied
12		Trigonella foenum	Santa accae	Powdered seeds with oil applied
13		Vetiver zizinoids	Leguminosae	Root paste is applied
14			Gramineac	

Plants used in Worts

Sr No.	Common Name	Botanical Name	Family	Method Of Use
1	Haldi	Curcuma Demostica	Zingeberace	Rhizome paste is applied
2	Dudhi	Euphorbia Hirata Podophyllum	Euphorbiaceae	Latex of plant is applied
3	Podophyllum	Hexandrum	Berberidaceae	Alcoholic extract is applied
4	Rurchaii	Tephrosia Vdlosa Vetiver Zizanoids	Pappilionace	Tea of fresh root is taken Internally
5	Khaskhas		graminae	Paste of root powder is applied

Market Preparations-

- Himalaya purim for acne
- Acne -n-Pimple Cream
- Deep Cleansing Astringent Lotion
- Neem Face Pack
- Purifying Neem Face Wash Gel
- Purim
- Dry/Sensitive Plus Combination Skin care pack
- Gentle Face Wash Cream
- Deep Cleansing Milk
- Apricot Scrub
- Intensive Face Moisturizing Lotion
- Refreshing Fruit Pack
- Revitalizing Night Cream
- Acne-n-Pimple Cream
- Lentils (Lens culinaris)
- Processed alum (Sourashtri bhasma)
- Shalmali (Salmalia malabarica)
- Five-leaved chaste tress (Vitex negundo)

- Indian aloe (*Aloe barbadensis*)
- Anti wrinkle cream
- Indian aloe (*Aloe vera*)
- Rakta khakasa (*Papaver rhoeas*)
- Grapes (*Vitis vinifera*)
- NEEM FACE PACK
- Neem (*Azadirachta indica*)
- Fuller's earth
- Turmeric (*Curcuma longa*)

SUMMARY AND CONCLUSION

Herbals are a rich source of active ingredients and can be safer and cost effective treatment for skin diseases ranging from rashes to dreadful skin cancer. More than 50% of plant species useful for treatment of skin diseases appear to be restricted to forests, so activities such as deforestation, habitat destruction, urbanization etc., may pose a serious threat to these species. To study and improve the quality of care for patients, we need accurate measures of the outcomes of skin diseases and their treatment. But health outcomes are especially problematic for dermatology. Traditional patient based outcomes, such as mortality, length of hospital stay, surgical complications, or tumor recurrence rates, are not relevant to many dermatological diseases. The vast majority of our patients are ambulatory, and most of them have chronic diseases that do not impair survival. The number of diseases affecting skin is much more than affecting any other organ. Besides these long term treatment is required and special care should be taken by the patient during the treatment. So skin diseases is to be taken very seriously and should be treated as any relevant symptoms appears.

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A COMPARATIVE ANALYSIS OF TEXT DETECTION TECHNIQUES IN SCENE IMAGES

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ABSTRACT

Detecting textual content in unstructured scenes is a difficult venture due to multi-orientation, perspective distortion, and variant of textual content size, color and scale. The trouble will become extra tough while the multilingual textual content in different orientations is encountered. In this paper, we describe the detection of textual content from natural images which incorporates pictures with textual content having one of a kind languages, one of a kind orientation (vertical, horizontal, etc.), one of a kind styles (stray pictures, textual content form etc. Following paper analyses one of a kind current strategies to stumble on textual content from one of a kind pictures inclusive of one of a kind orientations and styles. We have examined those strategies on preferred datasets which are as follows-ICDAR 2017, MSRA-TD 500, and Personalised Dataset. We observe numerous detection algorithms, a aggregate of exhaustive seek and segmentation. Five different existing algorithms (MSER, Otsu, Edge Based Text Region Extraction, Connected Component Based Text Region Extraction, Canny Edge Detection) are analysed and measured over standard performance parameters.

Keywords: MSER, OTSU, Text Detection, Segmentation

1. INTRODUCTION

Text elucidation in a scene image provides the most succinct natural language expressions to describe the scene detecting text in natural images is a challenging toil under active research. Detection of text in natural images is an important prerequisite for many content based applications such as blind navigation, automotive assistance, multilingual translation etc [1]. Detecting and localizing text in natural images is a challenging task because of variations in background, font, illumination, orientation, and language. In natural images, a text could appear on many different kinds of objects like product packaging, road signs, hoardings, medical prescription, signboards on shops, T-shirts worn by people etc. A lot of research has been going on in the field of text detection in unstructured images because of its multiple uses like driverless car, geo-location, image-based machine translation, robotic navigation, and automatic image annotation to name a few. However, even state-of-the-art systems [1,2,3,4,5] are not able to detect text accurately in complex environments as there are many factors involved such as potentially poor image quality, image distortions, motion blur, low contrast, staggering variety of text sizes and fonts, different orientations of text or presence of patterns visually similar to text. In this paper, we have analysed existing text detection methods and evaluated in terms of standard performance metrics.

2. METHODOLOGY

A major difficulty in detecting text in images captured in an uncontrolled environment is tremendous variations in illumination and lighting conditions. A number of text detection methods already exist, however, difficult to judge their performance as the output depends upon many different parameters. Five different existing methods (MSER, Otsu, Edge Based Text Region Extraction, Connected Component Based Text Region Extraction and Canny Edge Detection) are used in tandem to detect text regions in images.

2.1 Msr Text Detection

Maximally Stable Extremal Regions [6] is one of the techniques used to detect text regions in these images. The algorithm thresholds the input image on various gray values and connects the detected regions into component tree with spatial overlap. For each region, the change of size is calculated based on the size of the same region in one above and one below levels. MSER works well for text region detection because of the high contrast between text and the background along with near consistent text colors. Out of the multiple extremal regions detected by MSER, the regions exhibiting spatial proximity along with color, size and stroke width similarity are considered as text regions.

Enhanced MSER (EMSER) uses morphological operations for preprocessing. The dilation and reconstruction are used to enhance the images. The region filling is used to fill the text to be isolated from the background.

The mapping of image is given as $I: D \subset Z \rightarrow S$, Extremal regions are well defined if S is totally ordered and n

adjacency relation is to be defined as $A \subset DXD$. The regions are defined exclusively by the intensity function, this leads to identification of many key characteristics of the regions.

The input image is loaded and converted into gray image. MSER regions are found for the input image. All pixels inside the MSER have higher or lower intensities than in the surrounding regions and regions are selected to be stable over intensity range. The morphological operation dilation and reconstruction are used to improve the clarity of text and to find the connected components. The edges of connected regions are isolated using edge detection technique [7].

The step by step procedure of the MSER method is given below:

i. Loading the Input Image

Load the image I with size $M \times N \times P$ where $x_{i,j,k}$ refers the color intensity

$$\sum \sum \sum x(i,j,k) \text{ where } i \rightarrow 1 \text{ to } M, j \rightarrow 1 \text{ to } N, k \rightarrow 1 \text{ to } P$$

ii. Converting to Gray Color Images

Convert image I into gray scale image I1 where $x_{i,j}$ is the gray scale intensity

$$I1 = \sum \sum x(i,j) \text{ where } i \rightarrow 1 \text{ to } M, j \rightarrow 1 \text{ to } N$$

iii. Image Enhancement

Apply morphological operations image dilation and reconstruction with structuring element size 3x3 on the regions obtained in step 2.

iv. Edge Detection

v. Detect the Edges Present in the text region.

vi. Text Region Detection

Detect regions R which is subset of

$$I1, Q \subset I1$$

vii. MSER Detection

Detect extremal regions

$$Q \subset R \subset I_1 \text{ for all } p \in Q, q \in \partial Q \text{ and } \partial Q$$

is the outer region boundary.

2.2 OTSU'S Method

Otsu's thresholding method involves iteration along the entire probable threshold values and evaluation of standard layout for the entire pixel levels that occupy each side of the threshold [8]. The predominant objective is to compute the threshold value at positions where the addition of foreground & background spreads is minimally possible. Otsu algorithm attains satisfactory segmentation results when practiced under noisy constraints [9].

Otsu's Thresholding

Otsu's method is deployed by several image processing applications to execute histogram based image thresholding [10] or to transform a gray level image to a binary image [11]. The algorithm presumes that the image embraces bi-modal histogram (for instance, foreground and background pixels) and further evaluates the optimum threshold, partitioning aforementioned two classes so that their joint spread (intra-class variance) is negligible. The extension of the basic method to multi-level thresholding is named as Multi Otsu method [12].

In Otsu's method we minutely explore the threshold that minimizes the intra-class variance (the variance within the class), defined as a weighted sum of variances of the two classes:

$$\sigma_w^2(t) = \omega_0(t)\sigma_0^2(t) + \omega_1(t)\sigma_1^2(t)$$

Aforementioned weights ω_0 and ω_1 are the probabilities of the two classes separated by a threshold t and σ_0^2 and σ_1^2 are variances of these two classes.

Otsu formulates that minimization of the intra-class variances is correlative to maximization of the inter-class variance as:

$$\sigma_b^2(t) = \sigma^2 - \sigma_\omega^2(t) = \omega_1(t)\omega_2(t)[\mu_1(t) - \mu_2(t)]$$

It is expressed in the terms of class probabilities ω_i and class means μ_i .

The class probability $\omega_1(t)$ will then be calculated from the histogram t as:

$$\omega_1(t) = \sum_0^t P(i)$$

whereas, the class mean $\mu_1(t)$ is given as:

$$\mu_1(t) = \sum_0^t P(i)x(i)$$

where $x(i)$ is the value at the centre of the histogram bin.

2.3 Algorithm for edge based text region extraction

The basic steps of the edge-based text extraction algorithm are given below [13,14]

- Create a Gaussian pyramid by convolving the input image with a Gaussian kernel and successively down-sample each direction by half.
- Create directional kernels to detect edges at 0, 45, 90 and 135 orientations.
- Convolve each image in the Gaussian pyramid with each orientation filter.
- Combine the results of step 3 to create the Feature Map.
- Dilate the resultant image using a sufficiently large structuring element (7x7) to cluster candidate text regions together.
- Create final output image.

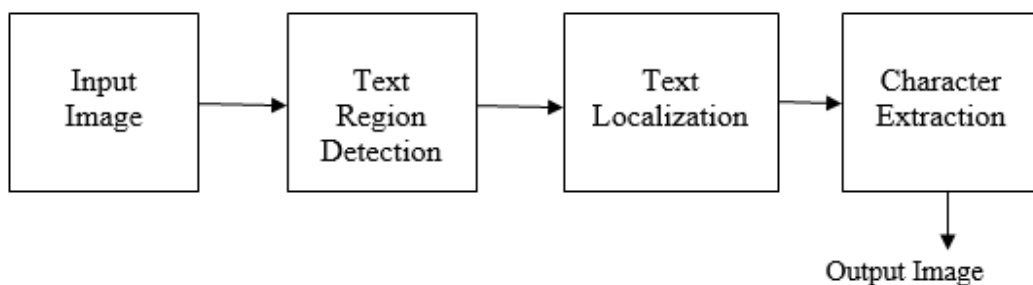


Figure 1: Basic Block diagram for edge-based text extraction

2.4 Algorithm for Connected Component Based Text Region Extraction

The basic steps of the connected-component text extraction algorithm are given below [15]

- Convert the input image to YUV color space. The luminance value is used for further processing. The output is a gray image.
- Convert the gray image to an edge image.
- Compute the horizontal and vertical projection profiles of candidate text regions using a histogram with an appropriate threshold value.
- Use geometric properties of text such as width to height ratio of characters to eliminate possible non-text regions.
- Binarize the edge image enhancing only the text regions against a plain black background.
- Create the Gap Image using the gap-filling process and use this as a reference to further eliminate non-text regions from the output.

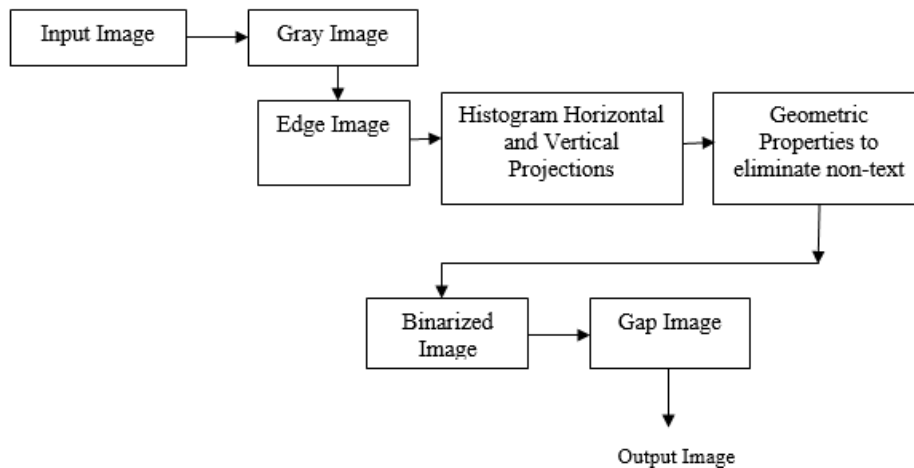


Figure 2: Basic Block diagram for Connected Component based text extraction

2.5 Canny Edge Detection Algorithm

The canny edge detector is an edge detection algorithm that uses a multi-stage algorithm to detect a wide range of edges in images. The process of canny edge detection algorithms can be listed:

1. Apply Gaussian filters to smooth the image in order to remove the noise.
2. Find the intensity gradients of the image.
3. Apply non-maximum suppression to get rid of spurious to edge detection
4. Apply double threshold to determine potential edges.
5. Track edges by hysteresis.

3. RESULTS AND DISCUSSION

In order to compare the existing methods, we conducted qualitative and quantitative experiments on public datasets.

3.1 Used Datasets

3.1.1 MSRA-TD500 (TD500)

It is the first standard dataset that focuses on oriented text. The dataset is also multilingual, including both Chinese and English text. The dataset contains 300 training images and 200 testing images. Different from ICDAR 15, TD500 is annotated at the level of text lines [16].

3.1.2 ICDAR 2017

There are number of datasets introduced by the International Conference of Document Analysis and Recognition (ICDAR), labelled by year. All the datasets listed below are scene text datasets, containing high resolution images (average size of 940 x770) of scenes which contain a variable amount of text within them[17]. The images are take with a range of cameras around urban areas, with varying levels of annotation. Many of the images are shared between the different years of ICDAR detests, including across training and test splits, so care must be taken when training on one year’s training dataset to evaluate on the test set of another year to avoid training on the test data.

3.2 Simulation Results (Pictorial Presentation)

Table 1: Result on ICDAR Dataset

ICDAR	MSER	OTSU	EDGE	CONNECTED	CANNY EDGE

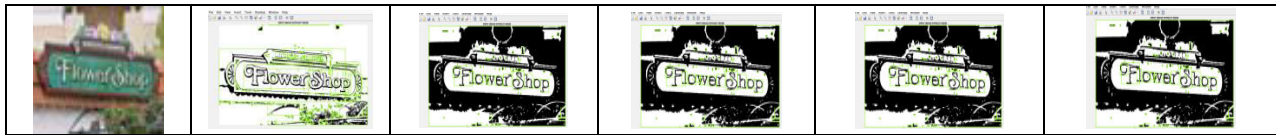


Table 2. Result on MSRA-TD500 Dataset

MSRA-TD500	MSER	OTSU	EDGE	CONNECTED	CANNY EDGE

3.3 Evaluation Metrics (Parametric Evaluation)

In order to evaluate the results objectively, we have use the widely accepted metrics: recall, precision, F-score.

3.3.1 Precision

Indicates how many of the detected items are relevant. Precision rate takes into consideration the false positives, which are the non-text regions in the image and have been detected by the algorithm as text regions.

$$PrecisionRate(\%) = \frac{CorrectlyDetectedWords}{CorrectlyDetectedWords + FalsePositives} \times 100$$

3.3.2 Recall

Indicated how many of the relevant items are detected. Recall rate takes into consideration the false negatives, which are text words in the image, and have not been detected by the algorithm.

$$RecallRate(\%) = \frac{CorrectlyDetectedWords}{CorrectlyDetectedWords + FalseNegatives} \times 100$$

3.3.3 F-SCORE

This is the parameter which correlates recall and precision.

3.4 OBJECTIVE RESULT (BASED ON PERFORMANCE METRICS)

Table 3: Results on ICDAR 2017 Challenge 4 Incidental Scene Text Localisation task

Algorithm	Recall	Precision	F-score
MSER	0.7347	0.8357	0.7820
OTSU	0.7419	0.8018	0.7707
Edge Algorithm	0.7842	0.7671	0.7755
Connected Component	0.6974	0.7492	0.7223
Canny Edge Detection	0.6981	0.7318	0.7145

Table 4: Results on MSRA-TD500

Algorithm	Recall	Precision	F-score
MSER	0.6102	0.7132	0.6576
OTSU	0.6365	0.6341	0.6352
Edge Algorithm	0.7932	0.7421	0.7667
Connected Component	0.6274	0.7092	0.6658
Canny Edge Detection	0.6742	0.7213	0.6969

The results obtained due to applying each algorithm as explained in Sec.2 are shown in Tables.1-2 and Tables. 3-4 on a varied set of images. This shows that MSER performs the best over ICDAR dataset while Edge algorithm performs the best over MSRA dataset. A good explanation could be that all the images in ICDAR are horizontally oriented, and MSRA TD-500 dataset include multiple orientations of images. However, the overall result is also affected by other parameters i.e. languages, text styles, illumination etc.

4. CONCLUSION

In this paper, we've analysed numerous textual content detection strategies which stumble on textual content from multilingual and multi-oriented images and determined that photo orientation is one in every of the maximum important elements in textual content detection strategies along with different parameters. Possible guidelines for future research can consist of adapting the geometry formulation to permit direct detection of curved textual content, extending the concept to general object detection. The overall performance of a textual content detection technique also can be in addition advanced with pre-processing strategies along with image super-resolution and deblurring.

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MULTIDISCIPLINARY RESEARCH TOWARDS SUSTAINABLE DEVELOPMENT

“No Matter How Complex Global Problems May Seem, It Is We Ourselves Who Have Given Rise to Them. They Cannot Be Beyond Our Power to Resolve”

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ABSTRACT

As a concept, sustainable development is in conflict with traditional development based upon economic growth. Sustainable development is an attempt to formulate a programme that integrates different aspects (ecological, social, and economical) which were usually considered as separate from each other. Sustainable Development as a Civilizational Revolution. A Multidisciplinary Approach to the Challenges of the 21st Century expands the discussion on sustainable development, including ethical, technical/technological, legal and political aspects. Since it is not possible to solve environmental problems solely by technical means, without taking into account economic or environmental aspects, the degree to which they overlap is discussed. In addition it is necessary to emphasize the importance of social and moral considerations. A clean environment is a valuable attribute, but its achievement at the expense of high unemployment -- or some other form of severe social conflict -- cannot be regarded as action in line with the sustainable-development principle. The tremendous scope of these changes makes it reasonable to expect this new vision for development to achieve the status of a revolution comparable to those known from the past: the agricultural, scientific and industrial revolutions. Sustainable Development as a Civilizational Revolution. A Multidisciplinary Approach to the Challenges of the 21st Century will be invaluable to graduate and post-graduate students following advanced courses on sustainable development, scientists dealing with sustainable development, and academia interested in environmental and social sciences.

Sustainable development means development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This means that humans can sustain themselves by fulfilling their basic needs in a way which, a way which does not depreciate the amount of natural resources for future generations. The key pillars of sustainable development are social, economic and environmental. At a point when our natural resources are depleting at a very fast pace, sustainable development provides us an opportunity to sustain these limited resources and save them for further use and generations. It helps humans to understand the basic guidelines regarding the ways they can go ahead and protect the environment and Mother Nature. Sustainable Development helps us to undo the havoc which has been created by human beings in the last few years and centuries in the name of development and growth. It helps us to promote a more social, environmental and economical way of living. Most importantly, it makes us believe that changing our views to attain the same and promoting them in our actions is not a very difficult task. There are many ways in which we all, together, can practice sustainable development even in our daily lives. One of the few ways for us is; first, to aim for a clean and hygienic life for ourselves and at work places. Second, we should always aim at using non-conventional resources

In this context, the overall approach to sustainable development, considering all of its dimensions, is of crucial importance. The aforementioned definition assumes that both the economic and civilization development of the current world population should not be carried out at the cost of reducing non-renewable resources and damaging the environment for the sake of future generations, allowing them prosperous development.

The overall perception of sustainable development, taking into account all its dimensions, is crucial in this respect. The cited definition adopts that the economic and civilization development of the present generation should not be carried out at the expense of non-renewable resources' depletion and environmental destruction, for the benefit of future generations, who will also have the right to pursue their development.

Sustainable development is a highly integrated concept, while realization of sustainable development is a comprehensive multidisciplinary process involving coordination and function. The implications and implementation of sustainable development should be studied from multidisciplinary angles, including the ecology, economics, the social sciences, and technology. From the viewpoint of ecology, sustainable development depends on healthy ecosystems, while it is impossible to deal with the degradation of ecosystems with knowledge of a single subject. From the viewpoint of economics, sustainable development means a new understanding about traditional economic measures of gross national product and standard national accounting. Improvement of resource pricing and economic accounting is one of the key issues, but this process does not concern only economics, it also involves multidisciplinary knowledge. From the viewpoint of technology, the key issue is how to understand, master, develop, and apply science and technology correctly to

improve living standards and increase welfare and therefore improve sustainability of development. Cleaner production, in which multidisciplinary efforts are also reflected, is both an idea and a tool to promote sustainability. The process of setting up and monitoring the indicators of sustainable development also needs multidisciplinary knowledge.

INTRODUCTION

Sustainable development has recently become a very important theory for countries all over the world to deal with the relationship between the environment and development and has penetrated into all aspects of our life. Sustainable development is a highly integrated concept, which involves many subjects, such as economics, social sciences, culture, technologies, natural resources, and environmental fields, while realization of sustainable development is a comprehensive multidisciplinary process involving coordination and function. Sustainable development does not refute economic growth, especially the economic growth of poor countries. However, how to promote and realize economic development should be further studied. Based on natural capital and ecosystems, sustainable development must be coordinated with the carrying capacity of the environment and aim at improving life quality and advancing society. Meanwhile, implementation of sustainable development needs a proper policy and legal system, in which integrated decision making and public involvement should be emphasized. In addition, in view of intergenerational and intra-generational equity, sustainable development should not only take into consideration the conflict and coordination of population, resources, the environment, and development in one country or one generation, but also the conflict and coordination of population, resources, the environment, and development between different countries and generations. The Brundtland Commission of the World Commission on Environment and Development issued *Our Common Future* in 1987, and in this the concept of sustainable development was first raised as “development that meets the needs of the present generation without compromising the ability of future generations to meet their needs.” This definition gained broad acceptance, though some argue that this definition is more philosophical than practical. Consequently, many researchers and international organizations carried out studies on sustainable development from different angles. For example, from the viewpoint of ecology, sustainable development can be defined as improving life quality without exceeding the carrying capacity of ecosystems. From the viewpoint of economics, sustainable development can be defined as maximizing net benefit of economic growth while gaining service from natural resources continuously, or development and environmental policies that are based on cost-benefit comparison and deliberate economic analysis, reinforcing environmental protection, resulting in increasing welfare and improvement of the level of sustainable development. From the viewpoint of technology, sustainable development can be defined as establishing technological and technical systems that minimize wastes and pollutants. There are even more definitions of sustainable development from different points of view. Studies of these definitions and discussions show that sustainable development has implications of great affluence. It is both target and measures to achieve the target, and it emphasizes protection of resources and the environment in parallel with economic and social development. Each definition studies the conditions and ways of implementing sustainable development from the angles of different subject and forms different knowledge of sustainable development. To sum up, the implications and implementation of sustainable development can in no sense be studied from the viewpoint of a single subject; rather, it should be studied from multidisciplinary angles, such as ecology, economics, the social sciences, and technology.

- **The Ecology and Sustainable Development** What does sustainable development have to do with ecology? From the viewpoint of ecology, sustainable development depends on healthy ecosystems. All our economic systems, our life-support systems, and our quality of life depend on continuous and adequate functioning of the earth’s ecological system. From a very broad point of view, the existence and development of human beings are maintained by the water cycle, biogeochemical cycle, climate system, biodiversity, and a well-functioning ecosystem. To sum up, ecosystems mainly include the following: • Providing vital resources for human activities: in fact, natural ecosystems of the earth—living organisms interacting with each other and their physical environment—provide humans with a vast array of marketable ecosystem goods, such as seafood, forage, timber, many industrial products and their precursors, and also soil and production and recovery of soil fertility, and biodiversity including diversity of genes.
- **Providing a life-support system:** ecosystems also provide services that are fundamental parts of our life-support system, including purification of air and water, detoxification and decomposition of waste, stabilization and moderation of the earth’s climate, moderation of floods and droughts, generation and renewal of soil and soil fertility, etc.

- Eliminating and assimilating wastes and waste energy produced from human activities and environmental capacity, including purification of air and water, detoxification and degradation of waste, etc.
 - Providing spaces for living.
 - Providing amenity and aesthetics, etc. Sustainable development must be established in stable functioning ecosystems, especially those subsystems that are vital to human existence. However, human activities have placed great pressure on the environment in recent years. Accordingly, those anthropogenic environmental problems, especially global environmental problems, are now seriously affecting the normal functioning of ecosystems and thereby affecting international economic and social development. These problems mainly include climate change, ozone depletion, ocean pollution, loss of biodiversity, desertification, soil degradation, destruction and degradation of freshwater and forests, and accumulation of persistent pollutants in the environment. All of the above problems have destabilized the earth's biogeochemical system and thereby threatened sustainable development. To solve these problems, knowledge of a single subject is not sufficient. Multidisciplinary efforts are needed. Global climate change can be an example. Scientific evidence shows the impact on climate systems of anthropogenic activities and the cumulative effects, and thereby the impact on the biosphere and human beings. Economic analysis shows the probable costs and benefits of climate change and compares the cost effectiveness of different climate mitigation options. Development of technologies improves new energy-saving technologies and development of new energy sources, including new burning technologies such as Integrated Gasification Combined Cycle (IGCC) and some others that are still in the conceptual stages. Moreover, people have realized that these problems cannot be solved merely by technological advances. From the viewpoint of social science, irrational production and consumption patterns under different societal conditions should be studied to provide new ideas on energy consumption and lifestyles. These new ideas are very important for solving the problems. Similarly, study of and solutions to other environmental problems, especially global environmental problems such as ozone depletion, loss of biodiversity, and degradation of forests, also need multidisciplinary efforts.
3. Economics and Sustainable Development From the viewpoint of economics, sustainable development means a new way of thinking about the traditional concept of economic growth and capital, a new understanding about traditional economic measures of gross national product and standard national accounting. Traditionally, attention to development has been constrained to activities within economic fields and has not taken into consideration the externality of economic activities—depletion and damage of economic activities to the environment and natural resources. One reason is that what economic growth was concerned with was only produced capital, while the importance of natural capital and human capital in economic development was overlooked.

Actually, both natural capital and human capital are very important to economic development in addition to produced capital. For instance, natural capital provides raw materials and the capacity to eliminate wastes, while human capital proves to be a crucial part of capital and resources for development. Past experiences shows that economic growth is necessary but not sufficient to development. If damage to ecosystems by economic activities is not taken into consideration, then the carrying capacity of biological systems will be destroyed and thereby sustainability of economic development will be damaged along with the damaged ecosystems. Consequently, one important step is to consider rational pricing of natural resources and calculation of marginal social costs of pollution on the basis of a new understanding of what constitutes capital. In traditional standard national accounting, the value of natural resources and ecosystems, cost of environmental pollution, and depletion of resources are not adequately considered due to its limitation to purely economic analysis. Currently, discussions focus increasingly on modification of accounting systems. This process does not concern only economics, but also involves multidisciplinary knowledge.

One example is resource pricing and economic accounting. Many economists, ecologists, and ethicists are involved in the discussion about resource pricing and economic accounting. They have broken down the traditional theory of economics and consider the issues of resource pricing, trying to make prices reflect the value of resources and damage to environment by resource exploitation. Of the theories of natural resource pricing, the theory of marginal cost pricing is well accepted. According to this theory, the resource price paid by users should equal the cost of natural resource exploitation and depletion that is now undertaken by society and the cost of corresponding environmental damage. To sum up, the full price should include cost for resource proving and exploitation, cost of environmental damage and recovery cost, etc. Employing this theory, a comparatively rational pricing system can be set up. Currently, a series of research frontiers reflect the function of economics in sustainable development, including measurement and evaluation of natural resources, economics of sustainable agriculture, simulation of ecological-economic systems, policy implications of

ecological-economic analysis, ecological-economic solutions to environmental degradation, ecological valuation, resources accounting, environmental rights, and environmental taxes. This research and its contribution to sustainable development should also be multidisciplinary.

The basic documents include the municipal sustainable development strategy, however the environment protection programme, tourism development strategy, promotion strategy, branding, the programme for historical monuments' protection, the study of determinants and directions for spatial development, low-emission economy plan and the strategy for solving social problems are also of major importance. Therefore revitalisation is a part of a broadly approached sustainable development, becoming its vital component.

In terms of sustainable development, the natural environment remains its base, the economy stands for its tool, and well-being along with high quality of social life are the goals of taking respective actions. The important components of the sustainable development concept, reducing the use of renewable resources to the level defined by the capacity of restoring them, include limiting the use of non-renewable resources within the scale, allowing their gradual replacement by the appropriate substitutes. In addition, it is important to eliminate consistently the hazardous and toxic substances from economic processes and maintain emissions within the limits set by the carrying capacity in the environment. ...

CONCLUSION

For the purposes of this study, sustainable development is defined as the process of transformations, which ensures meeting the needs of the present generation without reducing the development opportunities of future generations, e.g., owing to integrated activities in the field of economic, social and environmental development. The above mentioned definition assumes that both economic and civilization development of the present generation should not be carried out at the expense of depleting the non-renewable resources and damaging the environment, but having in mind the benefit of future generations who will also have their rights to develop. At this point, the importance of intergenerational justice should be emphasized and approached as the need for preserving the nature capital for future generations through economical management of natural resources, only a partial use of its potential, maintaining a dynamic environmental balance and the recirculation of resources.

Sustainable development is based on three pillars: society, economy and the environment, which need to be considered together. More in-depth analyses take into account also technical, legal and political dimension of sustainable development.

The overall perception of sustainable development, taking into account all its dimensions, is crucial in this respect. The cited definition adopts that the economic and civilization development of the present generation should not be carried out at the expense of non-renewable resources' depletion and environmental destruction, for the benefit of future generations, who will also have the right to pursue their development. The presented understanding of sustainable development was popularized as a result of publishing the World Commission on Environment and Development report, entitled *Our Common Future*.

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REVIEW OF APPLICATION OF PRECAST CONCRETE CONSTRUCTION FOR WATER RESOURCE ENGINEERING

P. D. Patil¹ and I. P. Sonar²¹Research Scholar and ²Associate Professor, Department of Civil Engineering, College of Engineering, Pune**ABSTRACT**

Precast concrete construction has proved its suitability in different existing structures still standing today. Sustainability is a global concern and hence the goal of human kind should be to create a sustainable world. In order to achieve sustainability, methods that are to be employed are effective utilization of currently available resources for a prolonged period of time, minimization of wastage of material, energy and controlling overuse and ensuring that there are reserves kept for future generations without complete exhaustion. It must be assured that precast is an easy, stable, economic, fast and a solution to environmental imbalance caused due to excessive use of materials and energy. In the present paper, a broad review is presented regarding the use of precast and prestressed concrete in water resource engineering viz. water tanks, water storage reservoirs, spillways, wing walls, box culverts, dams, cofferdams, pipeline, channels, irrigation canals, caissons.

Keywords: precast, pre-stress, water resource, dam, channel, water tanks, pipes, spillway, weir

INTRODUCTION

In order to maintain market value, the concrete industry needs to invest in research into new methods and ways of improving tried and proven methods of design and construction. Precast can be successfully implemented for various water resources structures. In this paper, detailed review is presented regarding the use of precast & prestress in different water resource engineering structures viz. water storage reservoirs, spillways, wing walls, box culverts, bridges, dams, weirs, pipes, canals, caissons, coastal protection structures.

I. Precast construction in water tank / water storage reservoirs

After building a 10-million gallon water storage reservoir in Regina, Saskatchewan, precast prestressed concrete system proved to be structurally efficient and economical. Similarly, in the project by Vern C. Rogne et.al.^[3], nearly 600 precast units (comprising structural wall panels, buttress panels, hollow-core roof members, roof support girders, columns, and architectural cladding panels) were used. Post-tensioning tendons were anchored at six heavily reinforced buttress wall panels. After erection of all panels, post-tensioning was done from outside the reservoir and joined the buttress together with the cast-in-place pilasters. Pilasters were cast-in-place to form the joints between precast wall panels. Post-tensioning ducts within the walls were spliced at this joint. The performance of the North West Reservoir had taken into consideration for the selection of the PSP (precast, segmental, post-tensioned system). Water tightness of the walls was achieved by prestressing of the wall panels in two directions, if special attention is paid to pilaster construction and the wall-to-footing joint. All this work has provided the effective use of the reservoir.

M. J. N. Priestley^[5] has elaborated the analysis and design of prestressed concrete storage tanks with a simple analogy. This method can be used with small microcomputers, or even the larger programmable calculators. One can model cylindrical tanks and tanks with double curvature for a wide range of loading, including dead load, fluid or gas pressure, thermal load and prestressing. The often ignored parameters in tank design viz. significance of shrinkage and swelling of the walls, creep redistribution of prestress and thermal effect actions are addressed. Author has studied cylindrical tanks with axisymmetric loading, cylindrical tanks with rotationally asymmetric loading, tanks with curved generators. The results predicted by the frame analogy are compared and more sophisticated analytical methods for a ground supported cylindrical reservoir and an elevated doubly curved tank are suggested. The method assumes rotational symmetry of both the tank and its loading. Finite element analysis under seismic loading, where the pressure distribution varied round the circumference, indicated that the method could be used with adequate accuracy for non-rotationally symmetric loading.

Rick Lennen, et.al.^[9] described the design and construction process being the project engineer, the owner and the precast concrete manufacturer. In this study, the functional requirements, planning, design considerations, and erection aspects for the construction of two 10 million gallon (37.9 million liter) precast, prestressed concrete water tanks in Spokane, Washington are discussed. These tanks had replaced a two-basin, 5-acre open-type reservoir. the combination of single pie-shaped tees for the roof and single tees with exposed aggregate flanges is used for the circumferential wall. Watertightness is achieved with the help of a synthetic liner. The advantages of using precast concrete were reduced maintenance, cost effectiveness, attractive aesthetics and the ability to restore the site to the original contours with backfill against the concrete walls.

There existed two philosophies for structural design of environmental concrete structures such as water reservoirs and sewage treatment tanks. The tanks were either fully prestressed or non-prestressed. In one case, the design philosophy was to prevent cracks by keeping the concrete in compression. In the other case, the design philosophy allowed cracks but limited the steel stresses to ensure that the cracks do not become too wide. **A. Rashed et.al.**^[11] developed a research program through the results of the experiment after investigating the concept of partial prestressing in liquid containment structures. In the experimental phase, a total eight full-scale specimens, representing segments from typical tank walls were subjected to load and leakage tests. A range of prestressed and non-prestressed reinforcement ratios were used in the test specimens. These were subjected to various combinations of axial tension and bending. Partially prestressed specimens clearly showed improved crack width and distribution under both pure flexure and pure tensile loadings. While the specimens were under load, leakage tests were conducted to obtain leakage rates through the cracks. The flexural compression zone prevented leakage in all specimens tested under flexure. In addition, through-cracks demonstrated auto sealing provided the crack widths were below a certain limit. These two aspects are important design parameters recognized in the design standards then.

Michael S Salu et.al.^[12] After reviewing the progress in the field of concrete water storage structures over the past 100 years, authors majorly observed the problem of leakage. Serviceability is the critical design case for all water retaining structures than the strength. Also, the design and detailing of joints is a critical issue. Prestressed concrete has a significant advantage over reinforced concrete in that regard. It locks the wall/floor joint so that the joint closes up under increasing water pressure. Reinforced concrete took time to make inroads into the reservoir market in Australia and then took nearly 40 years to mature as a technology. Prestressed concrete tanks first appeared in Australia in the 1960s and are now at a similar level where they are a mature technology. Authors concluded that the ongoing research and development will be required if concrete is to remain the dominant construction material for water industry structures.

After a brief investigation over “VSL concrete storage structures – Use of the VSL special construction methods”, **Alpay Burak Demiryurek et.al.**^[16] from Middle east technical university used slip forming system for constructing post tensioned concrete water reservoir. The advantage of slip forming is the short construction time, monolithic construction without construction joints and of high dimensional accuracy and cost savings even where the height is moderate. The model was created with defining a cylindrical structure with constant inner radius of 7.5 m along 25 meters height. The bottom 10 meters of the silo thickness was decided as 0.6 m and the upper 15 meters of the silo wall was adjusted as 0.4 m. The model was auto-meshed except outer foundation part. Walls of water tank were meshed at each one meter elevation and in radial direction model was divided into 36 parts, each part 100. The idea behind meshing was to model the structure better. Model was analysed for all possible forces, performed all checks and calculated horizontal & vertical reinforcement and designed suitable pile foundation.

R.J. Robson et.al.^[19] Mott MacDonald Bentley Ltd. (MMB) has promoted a new technique of constructing water retaining elements from precast wall units stitched together with in-situ concrete. MMB has designed and constructed 14 service reservoirs for Yorkshire Water Services Ltd. ranging from 136m³ up to 16,000m³. As part of the productization of the service reservoir design and construction, each of these reservoirs all use the same principle precast components. This technique has then been developed for application for reservoir spillway channels using similar components. Authors have provided a modular design which can be re-used, reducing both design and construction time across a programme of reservoir improvement works. This facilitated MMB to deliver a step change in the improvement of site safety, cost efficiency and assurance in construction quality. These projects and trials have shown that precast can be successfully implemented for both potable water storage and reservoir spillway designs. The method provides repeatable designs that improve the construction safety and the overall project delivery.

J. Gavranic et.al.^[21] described the design and construction aspects of three operational large circular post-tensioned tanks which were successfully completed then. Two approaches were in common use for tank design - two dimensional models for symmetric loadings and more accurate three dimensional finite element models for symmetric loadings. All the three tank walls were horizontally prestressed and vertically reinforced. When concrete tanks are post-tensioned, they become more durable than reinforced concrete due to the presence of residual hoop compression. The design code requirements for crack width control are fulfilled by satisfying the stresses in reinforcement steel to some extent. The construction of precast post-tensioned concrete tanks in Western Australia proved successful solution to the long-term water infrastructure requirements. With this result, tanks can be designed with a 100 years design life and with minimum maintenance due to the durable

nature of concrete and the post-tensioning to minimize the effects of concrete cracking. Water tanks are used to store water and are designed as crack free structures, to eliminate any leakage.

Prof A. R. Mundhada et.al.^[23] designed the reinforced concrete and prestressed concrete circular water tanks of same capacity and dimensions resting on ground and compared the total cost. Authors have developed computer program for solving numerical examples using the Indian Standard Code 456-2000, IS-3370-I, II, III, IV & IS 1343-1980. Authors provided the more economical, reliable and simple design of tank and the relationship curve between design variable have been produced. This work helps in understanding the design philosophy for the safe and economical design of water tank. Authors concluded that RCC tanks are cheaper only for smaller capacities upto 10-12 lac liters. For higher capacity, prestressing is the superior choice resulting in a saving of around 20%.

Nathan Crabtree et.al.^[29] presented case studies at Jackson's Edge SR and Oswestry WTW constructed by Carlow Precast specialist in the design, manufacture and installation of Design for Manufacture and Assembly (DfMA) Solutions to the challenging demands of the UK Water Industry. Manufacturer pour wet concrete against hard concrete and create DfMA infrastructure using a modern approach to established technologies. This process achieved all the requirements of conventional codes and standards for waterproofing integrity, also achieved durability with design life more than 100 years and capability without the introduction of unproven materials or construction techniques. In this project United Utilities constructed the first rectangular precast concrete (PCC) service reservoir. But the required size of PCC wall unit was more than any previously manufactured by the PCC supplier, Carlow Precast. JN Bentley had delivered many PCC structures within the water sector for various clients as well as to Carlow Precast. The roof of reservoir also was made up of PCC construction, in which roof slabs were supported by columns. To make the roof watertight, they used an intelligent leak alarm membrane which sits on top of the roof screed but below the backfilling material and is at the forefront of leakage monitoring and control. This design system were adopted as best practice within United Utilities organization.

Lars Balck et.al.^[30] presented history of circular prestressed water tank in this paper. This included how the development has taken place regarding the construction of circular water tanks using different materials or technology, viz shotcrete, prestressed concrete. Shotcrete was used as an integral part of wrapped prestressed tank construction, where floors and domes are generally cast with the concrete. Prestressed tanks were constructed by shotcrete for embedment and protection of the highly stressed prestressing wire or strand. The advantage of shotcrete being cement-rich, it can be used for the excellent corrosion protection to the steel and easily accommodates the curved surfaces without formwork. Some tank builders use shotcrete for construction of the entire vertical prestressed concrete wall using an embedded steel diaphragm for liquid tightness. These tanks are massive structures, ranging from a capacity of under 100,000 gal. (380,000 L) to over 30,000,000 gal. (110,000,000 L). Diameters range up to 350 ft (100 m) and with wall heights up to 70 ft (20 m). By 2017, five companies specialize in the construction of prestressed tanks and have built over 8000 prestressed concrete tanks worldwide over the past 75 years. Although equipment and construction techniques have certainly been refined and productivity increased over the last 75 years, the circular wrapped prestressed ground storage tanks built then are basically using the same design principles initiated by the Preload Company in 1941.

Water tanks are used to store water and are designed as crack free structures, to eliminate any leakage. **Novendra kumar verma et.al.**^[34] have designed two types of circular water tank resting on ground, with reinforced cement concrete (RCC) and with prestressed concrete (PSC). Both the water tanks were designed and compared with all respects. These both water tanks were of same capacity and M20 grade of concrete. Water tanks were analyzed, designed and estimated for the same capacity. It was then seen that thickness of RCC circular water tank is more than prestressed concrete circular water tank and other design data are different. The cost of RCC circular water tank is more than prestressed concrete circular tank. With the help of results, authors concluded that prestressed concrete circular water tank is economical for the construction purpose.

ii. Precast and/Or Prestressed Spillways

R. Baker et.al.^[7] developed and used precast concrete wedge shaped blocks for the construction of spillways. These blocks have used the hydrodynamics of the flow and achieved enough stability in high velocity open channel conditions as found on dam spillway. In this work, wedge concept is used and laboratory studies were carried out in Russia and UK. Seven dams in Russia have been built with spillways using this technology and experience at these sites is also reported. This team has prepared the design guide for the use of blocks as both a low cost method of lining chute spillways and for the protection of embankments subjected to overtopping.

The Omkareshwar Dam Project ^[15] was conceived in 1965 as an irrigation and power dam to be built in the Central Indian State of Madhya Pradesh. The broad scope of the project was to construct a spillway type dam across river Narmada. It included the construction of power house for electricity generation (8x65 MW) and a bridge over the spillway to serve the functional & operational requirement of the spillway. Precasting was the only viable and economical alternative to that situation. It was proposed to precast beams as primary structural element of the superstructure to reduce the construction time to minimum. The arrangement consisted of 6 numbers precast girders with cast-in-situ deck slab and end diaphragm. Precast girders were initially placed over the temporary supports over the pier caps using a suitable lifting / launching arrangement. The two girders were placed very close under the track load of stop log gantry to distribute the load among more girders. The fixtures for rail track would be embedded before casting of the deck slab. Once the concrete gains 28 day equivalent cube strength, the temporary supports were removed suitably. Subsequently, concrete wearing course, rail track and railings were installed.

Elite Precast Concrete Limited ^[18] developed & designed precast concrete wedge-shaped blocks which use the hydrodynamics of the water flow to achieve immense stability in high velocity open channel conditions those found on dam spillways. The blocks were manufactured to suit specific design and technical data. These blocks can be used for dam overtopping, high velocity channels, primary and secondary spillways.

Dam Spillway Blocks are a concrete protection system for embankment dams and spillways that are subject to high forces associated with overtopping flow. The equilibrium of the block is achieved by downward weight (positive force) of the block and the uplift pressure (negative force) of the flowing water, leads to be stable. To design of the overlay, an effective drainage system to remove the water from beneath is essential. The practical application of this dam spillway blocks is due to their economy and ease of installation. This can be used for projects where the use of large machinery is deemed impractical due to confined, remote location or environmental impact on the surrounding area. Dam spillway blocks are installed over site-specific filter fabric and subsequent drainage medium on a well-compacted surface.

Soviet Engineers proposed a stepped concrete chute design on the downstream face of embankment dams under the leadership of P.I. Gordienko for the first time. The choice of a stepped structure developed by **Hubert Chanson** ^[31] exercised the interlocking of individual precast concrete blocks with the next elements and the design assists in the energy dissipation (Chanson 1995, Chanson 2001). For new dams, a stepped spillway made of concrete blocks may be considered as the primary flood release structure of the embankment. The design concept was more recently tested in USA and UK, but it did not prove cost-effective there.

The concrete block system offers the flexibility of the stepped channel bed and allows differential settlements of the embankment. Individual blocks do not need to be connected to adjacent blocks. Also the construction requires less time on site. The blocks are laid on a filter and erosion protection layer. The layer filters the seepage flow out of the subsoil and protects the subsoil layer from erosion by flow in the drainage layer. The protection layer reduces or eliminates the uplift pressures acting on the concrete blocks. Geotextile membrane is laid on the embankment before the placing of the layer and another covers the protection layer before the installation of the blocks. Embankment overflow stepped precast concrete spillways provided in earth dam have common features with stepped storm water systems and sabo channel systems, which differ significantly from concrete dam stepped spillways. The channel has often a trapezoidal cross-section, the bed slope is moderate (i.e. less than 30 deg.) and the step height ranges from about 0.05 to 0.3 m. Further strong interactions may occur between seepage and overflow (e.g. Chanson and Tombes 2001, pp. 41-50). Therefore steep stepped chute results cannot be applied (Chanson and Tombes 2001, Gonzalez and Chanson 2004a,b). Chanson and Tombes (2001, pp. 46-50) further discussed a number of key issues, including the design of the downstream energy dissipator. Gonzalez and Chanson (2007) developed the particular case of small dams.

III. Precast wing Walls

Hynds precast concrete ^[13] developed one-piece precast concrete wing wall which deliver the improved inlet and outlet hydraulics for culverts, storm water outfalls and erosion protection. High strength and durability, minimum mass and protection against erosion, strategically placed lifting anchors make, safer and easier installation, split version for multiple barrel, extensive range of sizes are the product attributes. Products are approved & standardized as NZS 3109, concrete construction, NZS 3101:2006, concrete structures standards and attained ISO 9001:2008 quality management standards.

Iv. Precast Concrete Box Culvert

Forterra Pipe & Precast –Bismarck, ND developed and designed precast concrete box culverts and **Dale Schwindt et.al.** ^[32] presented the same in this conference. It consisted of inlet and outlet with sloped end

sections, which were cheaper than flared wing walls & easier to set in place with county forces. It can be easily extended with existing structures. Each structure is designed according to the fill height and loading applied to the structure. Designs meet AASHTO (American Association of State Highway and Transportation Officials) Standards and others as required. Type of sections available are single cell, double cell, regular barrels, beveled barrel sections, bends and special sections for storm sewer access points/tie-ins and look at site specific options.

V. Precast Concrete in Dams

In most hydro projects, a facility is required to flow the water beyond the turbine capacity to safely bypass the impounding structure and power station. For river schemes, a weir is typically used and for larger dams, a full spillway is required. **R. Baker**^[8] suggested precast concrete blocks, which has provided economical erosion protection for overflow sections of earth and rockfill dams and weirs. Wedge-shaped blocks can offer an efficient approach for providing needed protection.

Construction of the Meander Dam commenced in January 2007 in Australia, using a high speed construction method of precast and roller compacted concrete (RCC). The Meander Dam is 170 meters from abutment to abutment and 50 metres from upstream toe to downstream toe. Over 4,000 precast concrete units were made by **National Precast Member Duggans Pty Ltd.**^[14]. While panels and blocks were made in the precasters' Launceston factory, the intake tower sections and crest units were made at their Cradoc factory. Upstream face was manufactured from the 484 precast concrete panels which formed a smooth vertical surface. Each panel measured 5 meter by 1.8 meter by 100 mm and weighed 2.3 tonnes. The 484 upstream panels were manufactured on four fabricated concrete mould beds. The downstream spillway's stepped incline was made up of 3,060 concrete blocks, each measuring 2.4 meter by 600 mm and weighing 1.2 tonnes. The precast concrete downstream blocks were doweled together and were tied back into the RCC with tie bars with the upstream panels inter-locking edges locking into each other and again with tie bars securing them into the RCC.

In concrete dams on earth foundations, 50% to 60% of concrete works as ballast is necessary for creating the weight of structure for ensuring stability against sliding. For this purpose, **Tarek Mahmaud et.a.**^[22] developed precast monolithic cellular structures, which consists of longitudinal and transversal walls forming the carcass, the pre-cast concrete units with dimension 2-6m long, 0.5-0.7m height, 0.07-0.015m thickness. The compartments of the carcass are filled with soil material. Such cellular structures are used for constructing small head dams (up to 10 to 15 m high) and wing walls in medium to low head dams. Water does not create large horizontal pressures along the water side of the structure but also it gives a considerable vertical uplift pressure which takes place as a result of filtration flow. According to the head of the water level and the stress of the soil, the cross-section area and the shape of the silo dam can be determined by a very simple way. It's very easy to estimate the cross-section of the dam to achieve the stability between the weight of the dam and the pressure of upstream water.

French Development Enterprises, LLC (FDE) has developed the "French Dam" – an infrastructure technology that applies precast modules to construct powerhouses, dams, weirs and diversion structures. This paper by **Peter Drown**^[33] examines the application of precast concrete modules to be used as an alternative to conventional construction when applied to dams and diversion structures. This has reduced the cost and construction time for completion of new dams and hydropower structures. French dam has given one approach that can be applied to standardize and apply repetition in dam segment construction, to seek reduced risk, cost reduction and schedule improvement goals. Site-specific aspects will always be important and many elements of the primary structure can be constructed from precast concrete to enable precast concrete manufacturing, modularization and achieve economies of scale. The French dam has precast solutions, which reduces cost and schedule for dam rebuilding and new construction. Precast concrete modules can be designed to include hydro generation equipment or water supply conduits or assembled to fit unique project configurations. Conventional dams could be replaced by sectional precast concrete modular dams which can be built offsite and transported to multiple regional projects. The FDE modules have broad application in both overflow and non-overflow structures and for both new and retrofit/rehabilitation construction. Due to reduced on-site construction time, there are significant benefits to the dam construction industry, by limiting schedule and cost overruns and reducing risk due to weather delays in the construction process. The primary result of the FDE prototype construction process and corresponding technical evaluation report demonstrated that this new method of construction can improve the economics and reduce risk for this industry application.

In his research paper, **Jared Spaans et.al.**^[39] summarized the structural analysis and design for each stage of the concrete cofferdam during the construction of the new lock at the Kentucky Dam on the Tennessee River near Paducah, Ky. Also, an adequate crack control approach for concrete cofferdams is discussed, reviewing several U.S. codes and approaches. Authors presented a methodology for analysis and design of precast concrete

cofferdams using the example of the successful addition of a new lock at the Kentucky Dam on the Tennessee River near Paducah, Ky. Cofferdams are traditionally made from steel; however, several projects in the United States were successfully done in the past with precast concrete cofferdams. For construction of the new lock at Kentucky Dam, finite element analyses and adequate capacity checks, including crack control, were performed for precast concrete cofferdams in all construction stages. Ten unsymmetrical, approximately 15 × 15 m (50 × 50 ft) wide by 11 m (35 ft) high cofferdams with 300 mm (12 in.) thick walls were placed next to each other in the river from a river barge. These precast concrete boxes will eventually create one monolithic wall (the future wall of the lock). The main analysis and design focus for precast concrete cofferdams should include the following: a crack control approach, confinement reinforcement for the purpose of erecting/ lowering the cofferdam, critical construction stages regarding the global demand in the concrete cofferdam, determined in this case to be erection (stage 1), temporary uneven settlement on the piles (stage 2B) and the stage when the inside water is pumped out and lateral water pressure inward exists (stage 4). The solutions to these concerns presented in this paper were proved to be effective in practice. It can be concluded that precast concrete cofferdams represent an innovative and successful construction method. A wide variety of shapes can be made, as shown in the example of the last three cofferdams with temporary and permanent parts. Concrete can serve as future formwork and part of a permanent structure. Precast concrete is suitable for fast construction in the water for situations where rock is close to the surface.

Vi. Precast Concrete Weirs

For many decades, most of the weirs were built as a massive concrete structure across the river. Perhaps, in case of river with a high bed degradation rate, construction of fixed weir is not suitable. The conventional weir cannot accommodate the river bed level change and hence resulting the unstable structure. Also, the cost and time period of the conventional weir construction is quite high. Therefore, a new method of weir construction which called Modular Weir has been developed by **James Zulfan et.al.**^[37] The modular weir consists of precast concrete blocks, hooked and locked with one another to make it as a unit of structure. This structure has been tested on a scale model in the hydraulic laboratory of Pusair, Indonesia and applied on several rivers in Indonesia. After actual implementation in Cikarag River, the modular structure prototype worked well as a weir. The construction method is easier and faster which leads to time and cost saving. Therefore, this new method of weir construction can be an alternative for the weir construction.

Vii. Precast Concrete Pipes

Prestressed concrete pipe can replace conventional reinforced concrete pipe as well as steel and cast-iron pipes for high pressure supply lines. **Rajnikant Jayachand Kumbhani**^[1], in 1953, studied the suitability of prestressed concrete pipes for penstocks for water hammer, with particular reference to the comparative magnitudes of water hammer, materials wise economy and weights of the alternatively designed pipe sections. He worked out an ultimate design procedure for the maximum possible accidental water hammer in his thesis. He concluded that for sizes up to 12.5 ft, prestressed concrete penstocks may replace the reinforced concrete penstocks for 50 to 150 ft heads. And with the same size restrictions, prestressed concrete penstocks may also compete with steel penstocks for medium and medium-high heads. Prestressed concrete penstock reduces 20-50% maximum water hammer pressure, saves 75-85% quantity of concrete & 80-90% quantity of steel.

In New Zealand, prestressed concrete pipelines had been used in offshore environments for many years. Due to rigid pipelines with concrete pipe sections butted and glued together were post-tensioned over their entire lengths. During the installation of some long pipe strings, damage had occurred due to excessive flexure. In at least two cases, the cracks were observed due to deflection, which were filled with sand during installation and burial. This sand prevented the cracks from closing, thereby increasing risk of strand corrosion and eventual dislocation of parts of these pipelines. Hence, the suitable alternative was to construct a post-tensioned flexible pipeline. This project is situated near the City of Hastings in the North Island of New Zealand worked out by **R. W. Irwin, A. K. Thomson**^[4]. In this project, unique concept of a prestressed flexible jointed concrete pipeline is used, the word “prestressed” is the combination of stretched steel strands and compressed bearing elements. The system acts as two coupled springs, where the spring under tension represents the prestressing strands and the spring under compression the elastomeric bearings. The spring constant of the system is equal to the sum of the individual spring constants of the steel and elastomer. The performance of the two in tandem is similar to that of a prestressed ground anchor in contact with a compressed soil. The ability of the pipeline to bend easily about its horizontal axis during installation and burial was a major factor in the success of the installation of the structure by the bottom-pull (negative buoyancy) method of pipeline construction. No known damage was sustained during these critical phases. Construction work was carried out between 1978 and 1981 for 9000 ft (2743 m) of 45-in. (1143 mm) diameter concrete pipe and 1000 ft (305 m) of fiberglass diffuser.

The analysis of water pipes field data is of great importance as it has a significant impact on society and the environment. These failures also have an overall impact on the financial burden of the water utilities. In the thesis presented by **Rahul Manda**^[20], he conducted a review on the previous studies on prestressed concrete cylinder pipe (PCCP) performance. Also, a detailed national-level survey was conducted by the Centre for Underground Infrastructure Research and Education (CUIRE) at UT Arlington to gather and analyse additional field performance data for large diameter pressure pipe including prestressed concrete cylinder pipe. Specifically, this thesis evaluates the field performance of PCCP, which is one of the most conventional and extensively used large diameter (24 in. and larger) rigid pipes in the U.S. water pipeline industry and explores different failure parameters, such as pipe age, diameter, manufacturing process, type of joints and performance effectiveness of PCCP. The total footage of PCCP from all survey respondents is 632 miles and the overall failure rate for PCCP is 15 percent per 100 miles, the most common cause of failure reported in PCCP is external corrosion, prestressing wire breaks, joint failure and age of pipe, the most used diameter range of PCCP is between 24 in. and 36 in., which is about 41% of total PCCP inventory.

The purpose of the study presented by **Mehdi S. Zarghamee et.al.**^[24] was to develop the requirements on materials, design and installation of carbon fibre reinforced polymer (CFRP) renewal and strengthening of distressed prestressed concrete cylinder pipe (PCCP); so that the pipe, when subjected to the exposure environment, design working and transient pressures, gravity loads and live loads, shall have the necessary strength, reliability and durability to resist the loads throughout the design life as it continues to degrade in the exposure environment. The host PCCP is fully degraded from external corrosion, the prestressing wires are broken, the outer core is cracked, and steel cylinder is corroded and is perforated. The design of the CFRP liner for renewal and strengthening of PCCP is based on this process. The authors provided theoretical and experimental foundation for the development of an American Water Works Association (AWWA) standard on renewal and strengthening of PCCP, which will assist professional engineers and utilities in design, material selection and installation of CFRP liners in degraded PCCP lines. It was proved that when properly designed using qualified materials and installed properly, the CFRP renewed PCCP, will have the necessary strength, durability, and reliability against all failure modes. Some of these failure modes were discovered during this research. e.g, to validate the designs from a strength point of view, hydrostatic pressure tests were performed, resulted new failure modes related to water tightness that had not been known or considered in the draft Standard. In absence of such provisions in the Standard, water tightness would not be ensured and the pressure in the CFRP renewed PCCP could not reach the ultimate capacity of the pipe.

Prestressed concrete cylinder pipe is widely used for water distribution but structural failures have happened due to deterioration and a significant amount of money has been spent every year for repair and replacement. As the robot technique with fibre reinforced polymer to rehabilitate is being developed, there is a need for a new analysis method to predict the certain deterioration level. Till that time, no analytical tool was available for this purpose. **Yongjei Lee et.al.**^[25] has proposed an analysis procedure to predict the pressure and the radial displacement relation and the bursting capacity of prestressed concrete cylinder pipes under internal loading. The finite element method is used to validate the proposed method. It is found that the de-bond of pre-stressing wires; the number of the reinforcing layers and the layer attachment angle are important factors to pipe capacity.

At the bottom of slag dump site in water conservancy projects, large diameter reinforced concrete drainage pipes are often used for drainage. Due to the large depth of burial, if the prefabricated reinforced concrete drainage pipe is damaged during construction or use, it will have a great negative impact on the safety of the project and it will be very difficult to repair. There is no relevant basis in the water conservancy code and there are safety risks. Taking actual engineering as an example, the calculation results according to the design specifications and finite element analysis are compared and analyzed. The limitations of designing according to the water supply and drainage codes are explained by **Tang xiaoling et.al.**^[35]. Also gave the engineering solutions for the reinforcement design of prefabricated reinforced concrete drainage pipes with large buried depth. These results can provide reference for hydraulic engineering designers. In the water supply and drainage engineering pipeline structure design specification (GB50332-2002) and the water supply and drainage project buried precast concrete, it is recommended to consider the design and construction of the circular pipe structure design (CECS14:32002). It is observed that if the buried depth of the pipeline is large, the pipeline bearing capacity can be increased by increasing the height of the piping.

Prestressed concrete cylinder pipes (PCCPs) can suffer from prestress loss caused by wire-breakage, leading to a reduction in load-carrying capacity or a rupture accident. Reinforcement of PCCPs with external prestressed steel strands is an effective way to enhance a deteriorating pipe's ability to withstand the design load. One of the principal advantages of this reinforcement is that there is no need to drain the pipeline. A theoretical derivation

is performed by **Lijun Zhao et.al.**^[36] and this tentative design method could be used to determine the area of prestressed steel strands and the corresponding centre spacing in terms of prestress loss. The prestress losses of strands are refined and the normal stress between the strands and the pipe wall are assumed to be distributed as a trigonometric function instead of uniformly. This derivation configures the prestress of steel strands to meet the requirements of ultimate limit states, serviceability limit states and quasi-permanent limit states, considering the tensile strength of the concrete core and the mortar coating respectively. This theory was applied to the reinforcement design of a PCCP with broken wires (with a diameter of 2000 mm) and a prototype test is carried out to verify the effect of the reinforcement. The load-carrying capacity of the deteriorating PCCPs after reinforcement reached that of the original design level. The research could provide technical recommendations for the application of the reinforcement of PCCPs with external prestressed steel strands.

Ix. Precast Concrete in Canals/Channels

T.B.S. Rajput et.al.^[2] in 1980 investigated the feasibility for the use of unconventional materials, including lime, surkhi, plaster of Paris, fly-ash, cement, sand and gravel for the construction of precast channel. Author determined the structural strength and the seepage characteristics of different material mixes, modified the existing wooden form for fabricating the channel section and a simple and cheaper process of continuous (joint less) casting was developed for in-situ channel casting. Economic analysis of precast channel lining with unconventional materials was done. For the present study, wooden form was used to cast one meter long channel sections of 30cm x 20cm cross section. Ten different combinations of materials, including cement, sand, surkhi, lime, fly ash and gravel (maximum size 1 cm) were selected for casting the channel sections. Seepage rates had been reduced at a faster rate in the beginning but decreased with time & finally, the seepage rate became nearly constant which was taken as the steady state seepage rate. Plaster of Paris serves as a good sealant but when used with lime, it is not only ineffective but enhanced the seepage rate. Plaster of Paris increased the bearing strength of all the material mixes selected for the study. Though with a few material mixes plaster of Paris reduced the seepage rate but the cost of the amount of water saved because of its use could not compensate for its own cost. It was observed that this benefit-cost ratio was always more than 1.5.

Abul khair et.al.^[6] developed and designed precast low cost canal sections for smaller irrigation canals. Local wooden form was used for the construction of precast sections using suitable combinations of lining materials. After field testing of lining characters, following desirable canal sections have been selected. These sections are suitable for small irrigation canals in minor irrigation project where low cost hard surface linings are desirable for achieving greater conveyance efficiency. The materials used in the research work were precast rectangular concrete section (1:3:6) coated with bitumen emulsion U-10 and Precast rectangular cement sand surkhi section (1:3:6) coated with bitumen emulsion U-10.

Precast concrete slabs & bricks were used for lining the canal. In this paper, **Tahir M. A. et.al.**^[17] focused the use of local materials for concrete lining. Rawakeeb Research Station (RRS) experienced high water losses due to seepage. A concrete canal-let form (consist of two parts) was fabricated of 0.9 mm sheet metal to produce precast concrete canal-lets for lining of RRS canal. During pre-casting three problems occurred and resulted in failure of the form. A concrete slab form was well designed to avoid problems encountered by the first form. In order to develop jointing system, the precast concrete slabs were provided with acute angle of 45° clockwise along the width of the slab when laid horizontally. The developed jointing system, precasting technique and construction technique provided the required water tightness.

Surface irrigation methods usually encounter very low water use efficiencies. Hence, it is necessary to improve such systems to use the water efficiently. About 20% of the diverted water for irrigation was lost in tertiary canals. To provide high quality control, precasting was advised for mass production of tertiary canals. The objective of the study done by **Tarig et al.**^[26] was to minimize huge seepage losses encountered in Rawakeeb Research Station (RRS) using canal lining. The J-section was selected and forms made of metal sheets, angle bars and removable pins were designed for casting concrete canal-lets. Locally available aggregates (sand and gravel) were used for casting by developing an appropriate concrete mix. After casting, the blocks were left for one hour to allow for concrete setting then the form was released. The precast units were allowed to dry for 24 hours and cured for seven days using wet kenaf sacks. Cutting and embankment was estimated for the whole channel and the sub-grade was prepared by hauling gravelly soil from the vicinity of RRS. The sub-grade was thoroughly compacted using hand compacter. The slope was set out at 1 cm every 10 meters using a staff rod and engineer's level. The compacted sub-grade was elevated to the required level and a pair of precast canal-lets was placed to make the channel configuration while preserving alignment. The bottom and side gaps between each two adjacent pairs were filled with cement mortar made of locally available sand. The lined section proved to be efficient with smooth water flow while seepage was virtually eliminated. Moreover, conveyance time was

reduced from about 2 hours to 10 - 15 minutes (depending on the location of the field to be irrigated). The use of such precast canal lining will provide irrigation efficiencies in desert agriculture.

Jorge de Brito et.al.^[27] presented the main conclusions of a survey undertaken in Portugal canal lining, which concluded that in most situations the following technologies are used: concrete cast on site; precast concrete slabs; prefabricated membranes (polymer bitumen or synthetic). But the water loss due to inefficient water tightness was continued. These defects are classified by lining solution and their main causes identified. Finally, an exhaustive set of recommendations and rehabilitation techniques are described in order to minimize water leakage from the canals. This study can be used to provide the canal linings in Portugal and worldwide with efficient design and construction strategy. The major shortcomings were analysed and preventive or corrective measures were suggested. It was concluded that simple measures can be taken to prevent the problems. As in better developed areas of civil engineering, detailed designs produced for higher durability and performance, with minimal water losses, are both desirable and attainable.

Fattori system & structure in cement arameto^[38] developed and designed precast irrigation channels of various sections. These channels have the advantages as: elimination of water losses due to natural soil absorption or infiltration due to damage caused by rodents, near elimination of routine weed cleaning from the channel bed, simplification of irrigation interventions, low cost, simplicity and speed of installation, perfectly smooth inner surface that provides greater and better water flow, low environmental impact.

The channels are widely used, as well as in agriculture, also in road systems as a channel for collecting waste water at the roadside. The design is based on the assumption that they should be placed alongside transit zones for vehicles and people, therefore meeting certainly different safety criteria. The prefabricated channels are placed on plinths with dimensions chosen according to the nature of the land and in relation to the type of channel. The spigot joint enables connection between one element and another and the gasket ensures the water tight sealing of the product.

X. Use of Precast Concrete in Caissons

Sin-Ichiro Sekiguti et.al.^[10] designed and described the benefits of a new type of caisson called the “precast form caisson”. Caisson construction methods developed till then were using full-precast plates, whose joints were poor in durability and load bearing capacity. To overcome this, design and construction methods for compensating these weaknesses by using full-precast members are very complicated and made them inferior in cost and effectiveness. The authors used a precast form concrete caisson with half-precast members and a reinforced concrete composite structure to overcome these drawbacks. The caisson is made of H-steel and comprised a high-durability precast form and an RC precast form, which are filled with super-plasticized concrete. In July 1999, they produced a precast form caisson 14m long, 12m wide and 11m high in Tomakomai Port, to verify the method's effectiveness and economic feasibility.

As a contribution to labour and cost saving, **Hideo Sasaki et.al.**^[28] have developed a precast-form caisson that takes full advantage of precasting techniques. It has been demonstrated that the precast-form caisson can yield considerable labour savings during fabrication and reduction in construction costs was achieved in small amount. Future efforts to reduce construction costs will focus on reducing the number of compartments in the caisson, the mass production of high-durability permanent forms and the standardization of the forms into secondary products.

CONCLUSION

After reviewing these papers, it can be concluded that, in order to maintain market value, the concrete industry needs to invest in research into new methods and ways of improving tried and proven methods of design and construction. Precast can be successfully implemented for various water resources structures viz. water storage reservoirs, spillways, wing walls, box culverts, dams, weirs, pipes, canals, caissons. The method provides repeatable designs that improve the construction safety and the overall project delivery. RCC tanks are cheaper only for smaller capacities upto 10-12 lac liters. For higher capacity, prestressing is the superior choice resulting in a saving of around 20%. Partial prestressing is effective for improving the crack of the member in the tank over reinforced concrete tank. One-piece precast concrete wing wall was developed which deliver the improved inlet and outlet hydraulics for culverts, storm water outfalls and erosion protection. This new method of construction can improve the economics and reduce the risk for this industry application. Prestressed concrete circular water tank is economical for the construction purpose. Shear keys filled with cast-in-place concrete and transverse post-tensioned connections should be used to eliminate cracking in the joints. Precast concrete is suitable for fast construction in the water for situations where rock is close to the surface. Prestressed concrete pipe can replace conventional reinforced concrete pipe as well as steel and cast-iron pipes for high pressure

supply lines. Thus, it can be concluded that by using precast concrete in the construction of the different components in water resource engineering rather than conventional construction methods, we can achieve an easy, fast and cheap method of construction which have proved economical in many cases.

To add on this, use of precast concrete elements is proposed for the construction of weir or barrage across a river. Different precast elements would be assembled to construct a small water retaining structure followed by simulation in any compatible software and the same can be demonstrated across a river as a part of research work.

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RISK LANDSCAPE OF CLOUD COMPUTING

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Over time, as computing ease and functionality have grown, the IT industry has experienced from its users an ever-expanding desire for more information. With the web presence today, one can hardly imagine a day going by without accessing the web many times. Data are generated by the minute and are growing in variety and size; there appears to be no limit to where this appetite for more will finally face a “No, you cannot have it”. To serve this appetite, costs should decrease and/or value of information should increase. For example, early installations of client-server configurations resulted in poor server utilization (because a server was dedicated to processing a limited number of applications). The costs of servers grew as the server farms grew. To ease the pains of underutilization, virtualization emerged, which made it possible for servers to attend to more than one application.

Keywords: Landscape, Control Environment, risk, virtualization, Cloud Computing.

1 INTRODUCTION

Capacity utilization thus improved and cost of services came under some degree of control. Even as the idea of virtualization as applied to desktops and servers matured, the passion for virtualization lingered. If storage can be virtualized, why not applications, services, platforms and infrastructure? So the concept of sharing or abstracting through virtualization beyond just servers grew and produced a bigger picture, known as cloud computing. Conceptually, cloud computing is a network of information systems resources (hardware, software, knowledge, etc.) that provides web-centric online services. Broadly, it is a “generic infrastructural fabric” leveraged on the web for providing all kinds of services in a flexible manner. In the past, power infrastructures, for example, have changed society and the economy. For power, people do not need to have own generators, they can use any amount they want at any time and for any purpose. The highway networks provide a means to go from anywhere, using any kind of vehicle, and for any purpose. For sharing power, first a power grid was needed, and the highway network was designed by connecting various road networks so they could be shared to travel. For cloud computing, computational grids will need to be used to support huge data centers.

Although a lot needs to be accomplished before advanced use of cloud computing will occur, the wheels are in motion for a tectonic shift in the world of information systems. Call it a “disruptive technology” or “the next black swan,” cloud computing is here to change the entire spectrum of information systems domain. The cloud infrastructure, much like other infrastructures, will bring a sea change in business and life. According to The Economist, the rise of cloud computing is “more than just another platform shift. It will undoubtedly transform the IT industry, but it will also profoundly change the way people work and companied operate”. Gartner predicts that the market for cloud products and services will vault from US\$46.4 billion in 2008 to US\$150.1 billion in 2013. In light of constant pressures to reduce IT budgets, this is a welcome relief, though son of this growth may be funded by cutting existed IT outlays in other areas of information systems. Overall, it appears that a dynamic reallocation of information- systemsrelated outlays will occur due to potential advances in cloud computing.

Growth in Demand for Software Service While virtualization physically supported the notion of sharing and optimizing resource utilization, the logical driver of cloud computing has been software services. In recent years, Software as a Service (SaaS) has grown exponentially, thanks to the notion of sharing a centrally available computing resource. The simplest examples of SaaS include the offering of a wireless telecom company, U.S. cellular to store, maintain and back up contacts (for upload in the event one loses his/her device), and Amazon’s Kindle buyer. The customer does not need to own, maintain or operate the software, and yet, the benefits of the software accrue to the customer. The combined effect of virtualization and SaaS can be seen in cloud computing. Among the early cases of cloud computing are Amazon’s Elastic Compute

Cloud (Amazon EC 2) (an infrastructure), Google’s App Engine (a platform), and Microsoft’s Live Mesh (an infrastructure). Cloud Example one – Amazon’s EC 2 This article will focus on Amazon EC 2 as one example of cloud computing.

Amazon EC 2 allows people to set up and configure their own virtual machine on

Amazon's cloud. This means everything about their instances, from their operation system to their applications. Central to this infrastructure is what is called an Amazon Machine Image (AMI), which is a packaged environment that includes all the necessary logic to set up and boot one's own virtual machine. A unit of deployment can be used to create several building-block AMIs for one's unique needs (e.g., an application server, database, a web server) Once a custom AMI is created, it needs to be uploaded to Amazon S3 (Simple Storage Service). Amazon EC 2 uses Amazon S3 to provide reliable, scalable storage of AMIs, so that can boot them when asked to do so. The size and complexity of a customer's virtual existence depends on the customer. Mostly everything is scalable, and users pay for what they use and no more. Over time, as a user's needs increase, the user may buy more services, including storage of processing, and will be charged based on use at that time.

Cloud Example Two – Evernote Evernote's main function is to allow users to take notes in any form, for example, by snapping pictures, recording audio, capturing web pages or typing words. They cannot lose or misplace these notes because they reside in a cloud. Every file sent to Evernote is uploaded to a server farm somewhere. From there, files are accessible via just about anything connected to the web – the user's home and office computers, laptop, and cell. Say the user is browsing for recipes and finds a good one He/She can clip it into Evernote and view it on his/her phone while shopping for ingredients. Back at home, he/she can pull it up on his/her laptop and start making the new recipe. Aside from place and media independence, what really distinguishes Evernote is its uncanny ability to "read" text contained in images, which allows the user to say, take a shot of a business card and send it to Evernote, which will index the information and render it searchable.

2 LOGICAL CHARACTERISTICS OF CLOUD

Although, clouds vary in their functionalities and complexity, some commonalities among them can be traced. Technically, these are centralized data center(s) with all information resources available for users to meet their own information requirements. The example of Amazon illustrates the elastic nature of such data centers., where a vast array of different user needs can be met in a flexible manner. The following four logical characteristics are evident in cloud computing:

- 2.1 **Sharing** – A predominant feature of cloud computing is that it is a high-performance machine built to address user needs at the lowest common denominator, thus allowing users to share the provider's resources. For example, for developing one's own programming applications, a multitude of subroutines is provided; the user then embeds into his/her own logic without having to write monolithic code. The reusable components will be numerous and at the most basic level possible in order for users to pick and embed in their own constructs. In 2003, SAP introduced service-oriented architecture (SOA) into its software. It replaced its monolithic enterprise resource management (ERM) with a collection of reusable components that could be integrated into a whole according to the customer's need.
- 2.2 **Communication Bandwidth** – Historically, the sharing of software systems by credit unions, for example, has been done through dial-up systems. In this case, each credit union relies on a monolithic software solution and dedicated data storage at the provider's location to conduct its operations, make queries, update data and generate reports. This hub – and – spoke approach to sharing now belongs mostly to history. The new way of sharing is through the internet in the web environment. Consequently, communication bandwidth should be adequate and reliable. Very little will exist at the customer's end, for most everything will be in the cloud and not much will be able to done without the pipeline.
- 2.3 **Flexibility** – Historically, "sharing" implies use of resources in a relatively confined manner. For example, a customer's applications could be run be an external entity on a shared computer operated by the entity's staff. Now, sharing takes a deep dive into granularly. New ways of sharing mean anything can be ordered in any amount and to the minutest requirements. It is like going into a restaurant and choosing one's own bread, condiments, whether to toast the sandwich or not – all these decisions rest with the customer. Choice will be predominant and visible and the results will not be like a precooked meal. For example, SAP has now granulized its ERM logic components to a degree where customers can determine what to use and even, within selected components to a degree where customers can determine what to use and even, within selected components, how to modify them to fit their own needs. Ingredients are made available to users for their own recipe.
- 2.4 **Scalability** – Scalability here means that users will not have to worry about getting a second server or another storage device in case their needs grow. It is all provided in a seamless manner by cloud, regardless of whether the customer's needs increase or decrease. The elapsed time between the customer's need and supply of resources to meet the need will be insignificant. Equally important, the customer will not have to

worry about selecting specifications, acquiring and installing resources, testing them for reliability, etc. it is all in one place without the customer having to worry about time lags, functionality and interoperability.

3 RISK LANDSCAPES

The characteristics of cloud computing lead to enormous opportunities as well as risks. Some of the risks already exist, but will be elevated, and others are new. Taking stock of these risks is as important as knowing how to leverage this development for one's company. Because it is too early to know the exact configuration of a cloud, it is difficult to predict precisely what risks would be present at the forefront of this development. Depending on whether the cloud provides SaaS, Platform as a Service (PaaS) or Infrastructure as Service (IaaS), the risk scenario could be different for each case. Also, a great deal depends on whether the cloud services are provided by an internal cloud (having a cloud environment) with the organization) or an external cloud (outsourcing to a vendor's cloud environment) with the later likely posing greater risks.

However, it is not too early for IT auditors to begin to monitor cloud developments to grasp in a timely manner the changing risks. The discussion of broad areas of risk in cloud computing is divided into six categories:

- **Authentication** – The single most critical concern in the use of web-based services is the authentication of users. While technology for authentication has improved over time, there still are grave concerns about untrusted parties posing as authentic users and, if successful, causing data compromises. If most everything in terms of information resources resides in the cloud, this will be significant risk to be addressed. Presumably, internal clouds may face lower risk of authentication than external clouds simply because of the differences in the customer universe.
- **Data Security and Privacy** – Control over data on the web-managed vendors has been a matter of concern over the years. Even though the outsourcing option has gained popularity, customer organizations not only watch over the data protection standards their vendors use, but also mandate certain requirements of their own, and even perform their own audit. Despite this, the residual risks of losing data on the web remain high, and the customers organization cloud run into a crisis unless an in-depth security strategy is implemented for the cloud environment.
- **Interfacing with Internal Systems** – Most firms may not be able to outsource everything to an external cloud (e.g., system that address strategic initiatives, have intellectual property that comprise the core of its competitive strength or are so diverse that there are viable options in the external cloud). If these residual systems and applications are so diverse in nature, it will be a significant challenge to build interfaces for them. And even when such interfaces are in place, risk of data consistency and interoperability are likely to remain. Moreover, anything in-house, if connected to an external cloud, is subject to additional exposure from outside.
- **System Availability** – Business have moved from simple data crunching to integrated systems that are productive, seamless and strategic. Because they are lifelines for business, availability of such systems needs to be almost guaranteed. This means additional processes, data backups and redundancy; controls testing for availability requirements; and recovery strategies in the event of data loss. Not only will all this cost more, but it has to be reliable. Perhaps cloud vendors will be at an advantage in building a shared utility that provides for data availability for customers. Nevertheless, users' concern for loss of control will continue to surface as more is handed over to the clouds.
- **Business Continuity** – Business continuity in the cloud environment depends on the cloud vendor. Consistency, if using an internal and external cloud, one must be prepared to ask the question: "What if the vendor does not exist tomorrow?". Thus, the financial and operational viability of the vendor is at the center of the risk landscape. Add to this the facts the cybercrime is on the rise and there is a possibility that the clouds being used are somewhere around the globe in a risky region. Such risks are heightened because when most of the user's resources reside in the cloud, s/he is almost totally dependent on the cloud.
- **Ownership of Content and Other Legal Requirement** – When all systems' resources, including data and related applications are outsourced into a cloud, serious questions emerge. For example, who owns these data? Can one get these data back if the vendor ceases to exist? What will be the legal jurisdiction in the event of disputes and disagreements? Whose property will the application be if the applications are made through a unique assembly of granular subroutines of a software vendor? Who is responsible for data breaches? Legal complications could become a serious drag on a business and could potentially result in disruption in business continuity.

4 CONTROL ENVIRONMENT

There is little, in any, likelihood that physical and virtual worlds will exactly coincide. Not all locations of an organization are necessarily included in the virtual entity, but the virtual organization may extend beyond its physical perimeters into business partners, customers, service providers and the like. Thus, the articulation of a control environment must include significant and careful consideration of the virtual worlds – in this case, the clouds. Because clouds are “shared” by many customers using the electronic highway, it is crucial that IT auditors and control experts pay attention to not just protection and security within the perimeter, but also on the highway. It is important to have seat belts, rearview mirrors and air bags in a car, but it is critical to also have highway control, such as stop signs, traffic lights, guard rails and traffic cops. Similarly, air traffic control systems and safety requirements protect travelers from mid-air collision and other disasters. The cloud computing environment should include a careful and thorough consideration of controls over communication with the outside world.

Whereas outsourcing has until now been a matter of choice, the presence of clouds will elevate outsourcing as a matter of need. Therefore, the articulation of the cloud control environment must include all pertinent sources of risks of outsourcing of IT services. This focus on outsourcing may be limited in the case of internal clouds; however, the scenario is similar in that an internal cloud is also an outsourcing service for internal customers. Consequently, concerns about using internal cloud service are likely to be similar, if not heightened to the same level, as those in using external clouds.

5. CONCLUSION

It is too early to say what specific risks will emerge with the implementation of cloud computing. However, it certainly is time to begin mapping such risks to learn about the related risks and planning to mitigate them proactively. Strategic, tactical and operational aspects of sourcing decisions should be carefully and comprehensively identified and addressed. Potential risks with outsourcing information systems lies in the facts that the customer is dependent on the third-party outsourcing firm and there are likely to be significant exit barriers. Project planning and management risks, contracting and negotiation risks, transition and start-up risks, and provider performance risks must be addressed. Finally, the process of gaining assurance of services and related controls should be documented and appropriate aspect of it should be included in the outsourcing contract.

Requisite variety in the service level agreement (SLA) is the key to managing risks of external clouds. In other words, for every foreseeable out-or-control situation, an appropriate control response should be identified. Every aspect of risk must be considered, and its possible effect should be determined. Risk scenario should be built and discussed with the prospective vendors to learn how well the information resources are secured. A similar exercise for an internal cloud can be used to develop an internal SLA for cloud services to gain assurance of risk mitigation.

ENDNOTES

Virtualization is an approach to separating (abstracting) systems resources in terms of physical and logical dimensions. Thus, the same physical resources cloud serves more than one logical need. Such a separation could occur at any level, e.g., desktop, network, application, platform, infrastructure.

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EDITOR NOTE

- ISCA recently released a white paper, “Cloud Computing: Business Benefits with Security, Government and Assurance Perspectives.” The complimentary white paper is available for download at www.isaca.org/cloud.

ENERGY EFFICIENT TECHNIQUES OF 5G USING MILLIMETER WAVE WIRELESS COMMUNICATIONS

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ABSTRACT

In this paper we present a fifth-generation wireless technology continuously developed and extent to more progressive. The field of mobile technology provides improved network capacity, low latency, great availability, more reliability with intense speed. This paper introduces an overview of fifth-generation wireless technology accompanied by five other major technologies of 5G namely millimeter wave, small cells, Massive MIMO, Beamforming, and Full-duplex respectively. In addition, Energy Efficiency (EE) is an enormous strategy that immensely declines the circuit power consumption in fifth-generation cellular networks. This consequence is enhanced due to the rising number of antennas in massive multiple-input multiple-output (MIMO) systems. Energy efficiency has now become a fundamental aspect in the framework of communication networks. With the arrival of the fifth generation of wireless networks, with millions of additional base stations and billions of connected devices, the demand for energy-efficient system design and operation will be even more fascinating. Further, this paper outlines the various research work related to energy efficiency including the papers published in this special issue, and considers the most compelling research challenges to be discussed in the upcoming generation.

Keywords: 5G, Massive MIMO, Millimeter wave, small cells, Beamforming, Full duplex, heterogeneous networks, Energy Efficiency (EE).

INTRODUCTION

The area of wireless communication enhanced technically in advancing from 1st Generation to 5th Generation as 1G to 5G. These technologies comprise GSM, WCDMA, LTE, Wi-MAX, MIMO, and mm Waves facilitate voice calls, online data delivery with high speed, and texting. Now, in forthcoming generations, massive communication becomes possible between far things. It also employs voice, text, and data at very high speed. The comprehensive vision of the Future Generation Communication Systems (FGCS) is to accomplish high bandwidth, energy efficiency, low latency, and additional data delivery to allow good broadband services. 5G can hold up to a million devices per square kilometer, while 4G hold only up to 100,000 devices per square kilometer. More than speed, the lead benefit of 5G is its low latency. Latency refers to the timeline between the device asking the network and getting responses. 5G approximately eradicates the timeline. It means that the surgeon could be 1,000 miles away from the patient can control the equipment. It will favor the Internet of Things (IoT). 5G will also allow you to transmit your tactile or touch sensation in real-time. 5G empowers connecting vehicles and co-operating drones. It will also enable virtual reality, best streaming, guaranteed connectivity, and extraordinary quality. With 5G, the

number of devices connected to the network will increase tremendously. 5G is essentially Mobile Telecom Infrastructure, which is design to associate everyone in everything together comprising machines, devices, and objects. 5G carries three crucial things such as huge channels to speed up data, lower latency to be more compassionate, and the ability to connect many devices at a time. Compare to 4G, 5G has significantly lower latency (<10 milliseconds) and at least 10 times faster than 4G. 5G has more capacity that 4G such that it can handle 1000 times more traffic than 4G. It also used better spectrum efficiency. Electronic devices including cellular phones and wireless routers use definite frequencies on the electromagnetic

spectrum. The frequencies used by 4G telecom operators are typically up to 3GHz. As more and more devices are getting online, the current 4G frequency band is becoming crowded. Overcrowding within a small band of frequencies leads to dropped connections and slower speed. A major solution to overcome overcrowding is to allow devices to operate the frequencies in other bandwidth i.e., open up additional frequencies for telecommunication. Fifth Generation cellular network can exactly perform this. It operates under more frequency bands from 3GHz to 39GHz and possibly up to 300 GHz in the future. The use of this portion of the spectrum means more frequencies would be available for many more devices to communicate. In addition to getting more frequencies, 5G maintain its own set of trend new technologies as well. Evolution of generations of the communication standards demonstrated in figure 1.

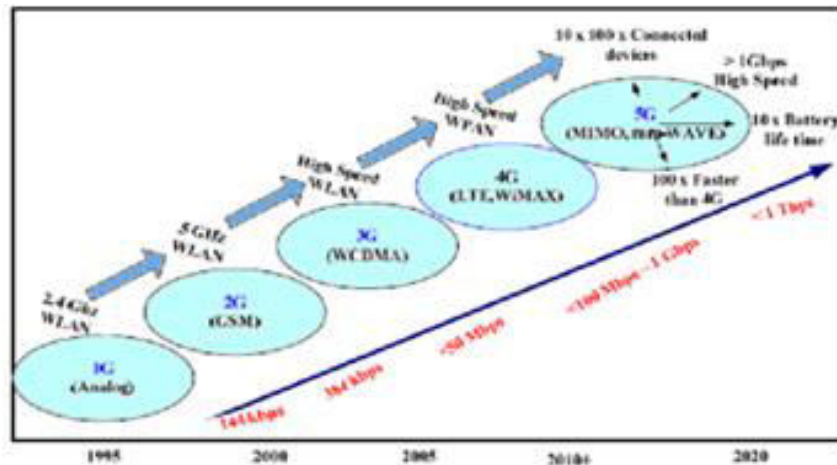


Fig.1 Evolution of generations of the communication standards

1G stands for first generation network includes the use of analog radio signals at the data rate of 9.6kbps to offer analog voice services i.e., Analog Telephony. In 1G, the analog signals are used with no data capabilities. It is commonly called an analog transmission technology that provides basic voice service. AMPS provides the first commercial cellular phone concept. The analog radio signals are employed with no data capacities, though digital signaling is managed to connect the radio towers to the rest of the telephone system by modulating (frequency modulation (FM)) the voice calls to a more immense frequency of about 150MHz. Alternatively, frequency division multiplexing (FDM) is used to isolate the bandwidth into definitive frequencies that are designated to respective calls. The cell size for a conventional 1G network is about 2-20km. The 1G network is set up on analog signals/protocol technology (FM) that determines one prevailing issue such as susceptibility to interference, which diminishes call quality. In addition, there was a lack of security due to no advanced encryption methods includes in analog signals. The 1G is entangled by limited capacity, huge phone size, lack of voice quality, less battery life, and frequent call dropping. It provides up to 30 KHz spectrum flexibility.

2G stands for second generation network developed on GSM standards. This generation upgrades as, radio channel used by 1G network is analog, while 2G network id digital. 2G was able to provide a significantly improved voicequality. It is the first digital data service in the advancement of cellular network technology. It provides secure short message service (SMS) and multimedia messaging service (MMS) services and becomes digitally encrypted to overcome some of the limitations of 1G. 2G capabilities are achieved by allowing multiple users on a single channel via, multiplexing. To enhance connectivity, 2G was able to provide a semi-global roaming system. In advance, the 2G global system for mobile communications (GSM) specification supports cell sizes of up to 35 km using macro, micro, pico, or femtocells.

C. 3G

3G stands for third generation network support broadband and multimedia services. It utilizes a new technology called UMTS. Urged slightly by the growth in internet and IP network technology, 3G architecture strengthens support for an embellished data rate (throughput speed) and QoS. 3G technology involves the services such as global roaming and enhanced voice quality. It enables mobile telephony. Due to the consumption of more power as compared to previous generations, it is less economical to set up and operate. Thus, it is a major drawback in 3G Technology. Furthermore, 3G UMTS is backward adaptable with prior generations of cellular wireless technologies through its capacity to endure in distinction with the estate GSM or AMPS technology. The progression from UMTS through High-Speed Packet Access (HSPA) and expanded HSPA (HSPA+) significantly brought enlarged end-to-end network performance and ultimately brought to the development of the next generation of networks i.e. 4G.

D. 4G

4G stands for fourth generation network that represents the generation of mobile cellular communication technology provide the broadband data transmission and broadcasting, in addition to very high-volume voice users. The architecture of 4G is based on , 4G Long Term Evolution (LTE) network, which is designed with to provide support for packet-switched traffic with seamless mobility, QoS, and minimal latency. This approach allows for the support of all services (data, voice, multimedia) through packet connections. The potential to accomplish the least latency, upgrading in Multiple Input Multiple Output (MIMO) techniques through discrete Radio Access Technologies (RATs) such as Orthogonal Frequency Division Multiple Access (OFDMA) and Single Carrier Frequency Division Multiple Access (SCFDMA) are elements of the crucial concerns and accomplishments of 4G technology. Diverse contemporary approaches such as carrier aggregation, relaying,

and Coordinated MultiPoint (CoMP) transmission and/or reception conclusively constructed and carried out to administer further enhanced peak data rates, support for heterogeneous network formation, and spectrum flexibility amongst other competencies are astonishing achievements contributed by 4G technology. The areas of multicasting and interference mitigation are other major enhancements brought by the 4G era. It involves multicasting services i.e. evolved Multimedia Broadcast Multicast Service (eMBMS). The 4G technology provides the fastest speed, reduced latency, and crystal-clear voice calls. The 4G offers speed up to 1.5Gbps.

E. 5G

The next generation wireless technology is 5G i.e., Fifth Generation Technology. 5G has the capability to reinforce an extensive number of connections concurrently while advancing speed, latency, reliability, and power consumption for handsets and Internet of Things (IoT) devices. It provide a speed of 100 times faster than LTE, with 1-10 Gb/s with Massive connections of 100- fold increase of supported devices to 1 mn devices/km². A 5G Technology provide Latency from 20 ms to 1ms Enhanced Mobile Broadband (EMBB), which provides faster data rates across wide coverage areas to improve various functions, including ultra-HD video streaming — Ultra-Reliable, Low-Latency Communication (URLLC), which broaden the speed and Quality of Service(QoS) in crucial functions, such as the control of robots and drones. Likewise, Massive Machine-type Communication (MMTC), associates the automatic generation, transmission, and processing of data among diverse machines without human invasion. Second Generation cellular telecom networks based on GSM standards were commercially launched in 1991 in Finland. It could deliver a data rate of up to 9.6Kbps. 2G introduced data services for mobile, starting with the SMS text messages. The three primary benefits of 2G networks over their predecessors were:

1. Phone conversations was digitally encrypted.
2. It was significantly more efficient on the spectrum.
3. It allowed far greater mobile phone penetration level.

Further, to achieve higher data rates GSM carriers started developing a service called General Packet Radio Service (GPRS). This system overlaid a packet switching network on the existing circuit switched network. GPRS could transmit data rates up to 160 Kbps. The phase after GPRS is called Enhanced Data Rats for GSM Evolution (EDGE). It introduced 8 PSK modulation and could deliver data rates up to 500Kbps using the same GPRS infrastructure. Now the internet is becoming more popular and data services becoming more prevalent. Development of 3G, includes 3GPP UMTS, the Universal Mobile Telecommunications system succeeded EDGE in 1999. This system uses Wideband CDMA (W-CDMA) to carry the radio transmission, and often the system is referred to as WCDMA. Further, the production of truly global standards, the collaboration of both GSM and UMTS was expanded from ETSI to encompass regional Standards Development Organizations. The fortunate establishment of such an extensive and complicated system stipulation expected a well-structured framework. This gives birth to 3GPP and worked under the observation of ITU-R. ITU-R is one of the sectors of ITU, which manage the international radio-frequency spectrum and to ensure the effective use of spectrum ITU-R defines technology families and associate specific parts of the spectrum with these families. ITU-R also proposed a requirement for radio technology. Evolution of 3GPP, started from GSM to Long Term Evolution Advanced. 3G wireless network aims to provide a minimum data rate of 2Mbps for stationary or walking users, and 384 Kbps for moving vehicles. The Fourth generation system or Long Term Evolution (LTE) contain some significant features as follows:

- Reduced delays, for both connecting establishment and transmission latency.
- Increased user data throughput.
- Increased cell-edge bit rate, for uniformity of service provision.
- Reduced cost per bit, implying improved spectrum efficiency.
- Simplified network architecture
- Seamless mobility, including different radio-access technologies.
- Reasonable power consumption for the mobile terminal.

The three fundamental technologies that have shaped the LTE radio interface design were :

1. Multicarrier technology
2. Multiple- antenna technology
3. The applications of packet switching to the radio interface.

In advancement, from services to multi-services i.e., from LTE Advanced to next Generation communication system is 5th Generation. The features of the 5th Generation includes:

Pervasive networks, in which users can concurrently be connected to several wireless access technologies and seamlessly move between them.

- Group cooperative relay, is a technique, considered to make high data rates available over a wider area of the cell.
- Cognitive radio technology, is a technique that would enable the user equipment / handset to look at the radio landscape in which it is located and choose the optimum radio access network, modulation scheme, and other parameters to configure itself to gain the best connection and optimum performance.
- Smart antennas are another major element of any 5G cellular system. Through this, it is the potential to modify the beam direction to facilitate communications that are more direct and inhibit interference and advance overall cell capacity.

While it can be argued that 3G and 4G technologies can connect peoples and partly things (objects or artifacts) in the case of 4G long term evolution (LTE) / LTE-Advanced (LTE-A). The developmental efforts to date towards the realization of 5G make it look increasingly indisputable that 5G will be able to connect everything, providing a seamless, coalescing connectivity for at least the next decade and possibly beyond. In other words, it suffices to assert that the advent of 5G will provide limitless access anywhere, at any time, for anyone, and anything. This is partly because this anticipated generation of technology, if successful, would create a unified air interface in establishing end-to-end connectivity between mundane things such as smartphones, fridges, freezers, boilers, cars, wearable, utility meters, and many more. To put it in technical terms, 5G brings a world of appreciably enhanced mobile data broadband, ultra-responsiveness, ultra-reliability, ultra-low latency, ultra-fast data rate, and enormous MTC/M2M or IoT capabilities. In 5G, the essential ingredients of radio resource allocation (a key component of RRM) including latency, throughput, reliability, QoS, and QoE are expected to be significantly optimized to entirely new, unprecedented levels. Several other key concepts, techniques, and schemes are CoMP, SC-FDMA, OFDMA, frequency division duplex time division duplex carrier aggregation (FDD-TDD CA), etc. One other key aspect of 5G is the evolution from cell centricity into device centricity, which exploits and harnesses intelligence at the device side (human or machine) such as via device-to-device (D2D). The target of 5G beyond 2020 is to fully commercialize 5G infrastructure deployment. Some advantages of 5G are as follows:

- It provides intense speed.
- Low latency: Latency is the time between accessing an event and the response to it. Low latency is the envy, relatively spontaneous, feedback that makes all from gaming to downloading videos a c easy accomplishment. A huge file, for example, that would take over 25+ hours to download with 3G technology grabs less than four seconds to download with 5G.
- Peer-to-peer (P2P) communications: One can easily transfer data between devices in a matter of seconds.
- Vehicle-to-vehicle communications (V2V): 5G communication makes it possible for cars linked to smart traffic management systems to exchange information such as location, speed, and destination.
- It provides better gaming experiences.
- It provides enhanced cloud gaming technology.
- Improved virtual reality: With 5G advancements, response time is whittled down to a mere couple of milliseconds.
- It provides Robotic medical advancements.
- This technology provides immense development in the field of Robotic surgeries.
- It provides an evolution of IoT.

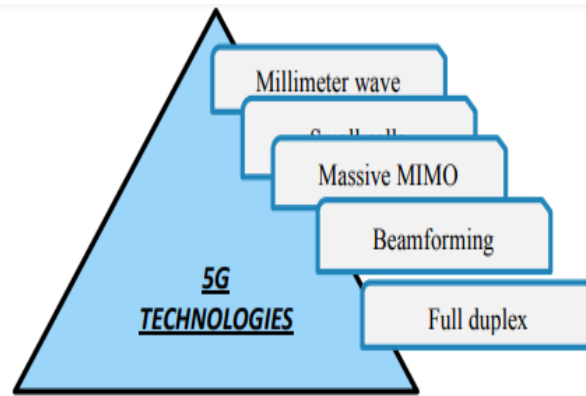


Fig.2 Major technologies of 5G.

The five major technologies in 5G are Millimeter wave, small cells, Massive MIMO, Beamforming, Full duplex illustrated in figure 2. The electromagnetic waves are used while communication, which is classified as seven types, namely: Radiowaves for instant communications, Microwaves for data and heat, Infrared rays for invisible heat, Visible rays allow seeing, Ultraviolet rays are energetic light, X-Rays can penetrate our body and Gamma rays are nuclear energy.

The communication between the two stations in mobile communication refers to Air Interface or Access Mode. For

wide-area coverage, 5G networks operate up to three frequency bands: Low Band 5G, Mid band 5G, and High Band 5G. frequency band of 5G network shown in table 1.

Table I Frequency Bands of 5g Networks

Frequency bands	Range	Features
Low Band 5G	600 MHz - 850 MHz	<ul style="list-style-type: none"> • Similar to 4G • The low band cell towers have a coverage area range similar to 4G cellphone towers. • Speeds are 30-250 Mbps
Mid Band 5G	2.5 GHz - 3.7 GHz	<ul style="list-style-type: none"> • Frequencies are used in the Microwave range. • Cell tower coverage is upto several kilometers in radius. • Speeds are between 100-900 Mbps
High Band 5G	25 GHz - 39 GHz	<ul style="list-style-type: none"> • Frequencies are used in the Microwave range. • Limited coverage range and needing small cells.

A. Millimeter waves

Millimeter waves broadcast at frequencies between 30 gigahertz to 300 gigahertz. As, they vary in their wavelengths from 1 millimeter to 10 millimeters hence, named Millimeter waves. In comparisons with radio waves, used in today’s smartphones measure 1,000 times longer than Millimeter waves. So far, Millimeter waves were used in satellite communication as well as in RADAR operations. Some cellular providers become bigger to use them to exchange data between two stationary points. However, using Millimeter waves to connect mobile users with nearby base stations is entirely a new approach. The major problem is that it cannot easily travel through the buildings and obstacles. In addition, trees, plants, and rain can easily absorb Millimeter waves. This consequence can be overcome by another 5G technology such as Small Cells.

B. Small cells

Small cells are mini portable base stations, which require very low power. Millimeter waves cannot penetrate plants and buildings. Thus to prevent signals from the drop telecom operators may install thousands of small cell base stations in a town to create a dense network. Each base station will receive signals from other base stations and may forward data to users. A dense network of small cells increases both ratios per subscribers and provides improved signal quality for more efficient data transfer. A shorter distance between radio sizes also helps to overcome the short signal distance reach of millimeter waves or the other higher frequencies in the 5G radio spectrum. Due to the combinational intricacy of low-complexity joint antenna selection and user, a small cell becomes the leading solution to increasing the data capacity of the network. Small cells are small to be enough to be installed on the light poles or the top of the residential buildings. This dense network provides more targeting and efficient user spectrum.

Spectrum refers to the number of frequencies available to communicate. This is a very scarce and expensive resource. Installing more base stations in 5G small cells means the frequency that one base station uses with the mobile devices in one area can be reused by another base station in a different area to serve another user. It shows that a smaller cell leads to greater use of frequencies and hence provides high spectral efficiency.

In early times, we had radiotelephones in cars. In this system, there was one central antenna tower in a city and perhaps 25 channels available on that tower. Since the center antenna is so far, the phone in the car needed a powerful transmitter to reach the antenna far away. In addition, limited the number of available channels met that many peoples can use it simultaneously. Meanwhile, cell phones came out, which divide the city into many small cells, which allow the frequency reused across the city such that many people can use cell phones simultaneously. In the typical analog cell phone system in the US, a carrier was granted about 800 frequencies in a city. Carriers then divided the city into many cells and reused frequencies across them to allow many users to use cell phones simultaneously. IN small cells, it is difficult to set up a large number of small cells required to build up 5G network in rural areas. In addition, for broadcasting over millimeter waves 5G base stations will also help to have many more antennas fitted into the base stations of today's cellular networks. Fitting many antennas into a smaller sizes is a big issue, which is overcome by another 5G technology called Massive MIMO.

C. Massive MIMO

Since length of an antenna is half of the wavelength of the waves it emits. Also, the wavelength is inversely proportional of frequency, so, higher the frequency in 5G, the smaller will be the size of the antenna. If the size of the antenna is small we can fit many more antennas into one array, which means we can build small cell base stations with a large number of antennas fitted into them relatively more easily. 4G base stations have about a dozen antenna ports. These ports manage all the cellular traffic, out of the 12/8 ports are for transmitters and 4 ports are for receivers whereas 5G base stations can support about 100 ports, which means many more antennas can fit into a single array. This increased capability means that the base station can send and receive signals from many more users simultaneously. Thus, the capacity of mobile networks increases. Continuously, using two or more antennas for input and output signals that are receiving and sending signals is called MIMO, which stands for Multiple Input Multiple Output.

In massive MIMO, dozens of antennas are used in a single array. Hence, the word massive was used along with the concept of MIMO. The most commonly seen definition of massive MIMO is that it is a system where the number of antennas exceed the number of users. In practice, it is called massive when there are 64 or more logical antenna ports in an array in a base station.

D. Full duplex

In addition, to using massive MIMO, 5G engineers also trying to increase throughput and decrease latency by using the technology called full duplex, which modifies the way the antenna transmits and receives the signal and data.

In 3G and 4G networks, the two basic configurations for sending and receiving signals such as Frequency Division Duplexing (FDD) and Time Division Duplexing (TDD) are used. In FDD, transmission and reception happen at two different frequencies. The second configuration refers to Time Division Duplexing (TDD). In TDD, the send signal is separated from receive signal by using different time slots in the same frequency band i.e., the send and receive signals take turns, sends or uplink signals connects for few seconds and, the downlink or receive signals connects for the next few seconds. The full duplex has the ability of the transceiver to transmit and receive data at the same time for the same frequency. These technologies can potentially double the network capacity in a full duplex. The spectrum efficiency improved greatly in comparison with half-duplex (HD). But, there is a problem in the full duplex that is signal cell interference S_i in the signal leakage from transmitter to its own receiver there are some techniques to overcome this problem which are as follows:

1. Propagation Domain SI suppression,
2. analog domain SI cancellation,
3. Digital domain SI cancellation

However, there are some other obstacles in achieving theoretical full duplex such as Residual cell interference, Traffic constraints, and Intracellular and Intercellular interference.

E. Beam forming

MIMO has a big limitation. The Antenna sends the signals in every direction at once. Therefore, when so many antennas are positioned so close to each other, it causes interference in signals emitting by different antennas. To address this challenge, there is another technology called Beam forming. Instead of broadcasting in every

direction, a 5G base station sets a focused beam of data to a particular user refers to as Beam forming. Many times, the terms Massive MIMO and beam forming are used interchangeably. Further, in reality, Beam forming is used in massive mimo. Beam forming is a subset of massive MIMO. Beam forming has its subcategories, which are as follows:

1. Digital Beam forming is also known as Precoding.
2. Analog Beam forming.
3. Hybrid Beam forming.

Massive MIMO used many antennas. Since these antennas are located too closely to each other; there is interference among the signals sent out by these antennas. To avoid interference, Beamforming is used. Beamforming controls the direction of the wavefront and can be achieved by appropriate magnitude and phase of the signal transmitted by an individual antenna in an array. In other words, the same signal is sent from different antennas but there is a phase difference or space between them of at least half wavelength. This causes constructive interference of signal waves in one direction and causes destructive interference in all other direction i.e., a beam or a lobe is formed in one direction while rest in another direction. At the receiving end, the user gets multiple copies of the same signal, one each from different antennas. However, depending upon the receiver via tower these multiple signals may be in opposite phases,

and get destructive interference and hence cancel out each other or get constructively interference to create a stronger signal.

Since, antenna contains a radiating element, which emits electromagnetic radiation in all directions. However, instead, focus the radiation in all directions, if the user needs to focus the radiation in one direction then, there is a need of more than one antenna radiating element to feed them with the same signal. It refers to the single antenna with a more directed signal. For example, if we use two radiating elements placed next to each other, we get twice the energy in one direction and less energy going sideways in other directions. This two times energy is known as three decibels. Similarly, if we have four radiating elements and feed them with the same signal, we still have one antenna but we will get four times the energy going forward in one direction known as six decibels. The problem with this is that the receiver has to be in front of the antenna, if the receiver wants to be on the side the signal will not reach it. Therefore, to target the beam in the same direction, we need to change the direction of the antenna or we need to feed each radiating element with the same signal but with different phases. If the signal to all radiating elements is the same except that they have different phases, we will have constructive interference in one direction and there will be destructive interference in all other directions. Instead of different phases, we can also use different amplitudes to have constructive interference in a given direction and create different types of beams.

By varying, the input signals to the radiating elements one can create multiple beams as well. These beams could go in different directions. In fact, one can also create a beam, which goes directly a user standing at the foot of the base station. This process of sending multiple beams is known as Spatial Multiplexing or Spatial Division Multiple Access (SDMA) in which number of antennas is same as a number of input signals. One can multiplex as many beams as the number of antennas

CONCLUSION

In this paper, we have discussed the outline of fifth-generation wireless technology followed by five other major technologies of 5G namely millimeter wave, small cells, Massive MIMO, Beamforming, and Full-duplex respectively. Also, Energy efficiency has now become a fundamental aspect in the framework of communication networks. With the advent of the fifth generation of wireless networks, with millions of increased base stations and billions of connected devices, the insistence for energy-efficient system architecture and operation will be indeed more compelling. Significantly, this paper summarizes the diverse research work that gives an account of energy efficiency comprising the papers published in this special concern. Further, investigating energy-efficient massive MIMO systems in the Heterogeneous networks a leading challenge in the research field.

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ENERGY EFFICIENT TECHNIQUES OF 5G MILLIMETER-WAVE CELLULAR ACCESS NETWORKS ANALYZE THE COVERAGE PROBABILITY WIRELESS NETWORKS

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ABSTRACT

In this paper we present a millimeter wave (mmWave) wireless networks. In particular, we study the impact of base station (BS) antenna tilt angle optimization on the energy efficiency (EE) of mmWave networks under two different scenarios: a homogeneous network consisting of multiple macro base stations (MBSs), and a heterogeneous network where several femto base stations are added within the coverage areas of the MBSs. First, by adopting a stochastic geometry approach, we analyze the coverage probability of both scenarios that incorporate 3DBF. Then, we derive the EE of the networks as

a function of the MBS antenna tilt angle. Next, optimization problems are formulated to maximize the EE of the networks by optimizing the tilt angle. Since the computational complexity of the optimal solution is very high, near-optimal low-complexity methods are proposed for solving the optimization problems. Simulation results show that in the mmWave networks, the 3DBF technique with optimized tilt angle can considerably improve the EE of the network. Also, the proposed low complexity approach presents a performance close to the optimal solution but with a significant reduced complexity.

Keywords: energy efficiency, heterogeneous network (HetNet), mmWave network, stochastic geometry, tilt angle optimization.

INTRODUCTION

5th generation (5G) cellular systems need much more bandwidth

compared to current cellular networks. The millimeter wave (mmWave) frequency bands have recently attracted a lot of attentions due to large bandwidth that they offer [1], [2]. However, performance in term of spectral efficiency and energy efficiency (EE) [6], [7]. On the other hand, due to the short wavelength of the mmWave bands, a large number of antenna elements can be packed in a small area arrays which makes them suitable for employing the 3DBF. One of the recent powerful mathematical techniques that has been proposed for analyzing the performance of cellular networks is stochastic geometry (SG) [2], [9], [10]. This technique is widely used in evaluating different network performance metrics including coverage, capacity, spectral efficiency and the EE in the microwave as well as mmWave systems. An SGbased mathematical framework to model random blockage in the mmWave networks has been proposed in [3] in which the authors proved that the distribution of the number of the blockages in a link follows a Poisson distribution. In [2], the SG approach was employed for analyzing the coverage and rate of the mmWave networks and it was shown that the mmWave networks achieve a comparable coverage but higher data rates than microwave networks. Also, the SG technique was employed in [11] to evaluate the performance of multi-tier networks and it was shown that a sufficiently dense mmWave cellular network can outperform microwave cellular networks in terms of the coverage probability. In addition, the downlink of a multi-tier heterogeneous mmWave cellular network in a Nakagami fading channel was investigated by a SG approach in [12]. In [13], the effect of user association and power control on the coverage and EE of the mmWave system is investigated. The maximization of the EE by considering a constraint on the coverage probability is studied in [14] which provides insights for deployment of an energy efficient mmWave network. In this paper, we address the problem of the 3DBF in the mmWave networks. In particular, our work focuses on the EE maximization in the mmWave networks by tilt angle optimization at the BSs that are equipped with active antenna systems. To the best of our knowledge, this problem has not been studied before in literature. Furthermore, for our analysis, we use a stochastic geometry approach. In this approach, the location of BSs are modelled by a homogeneous Poisson point process (PPP). In addition, we use a modified model for the propagation channel that properly incorporates the existence of blockage effect in the environment. Using the above assumptions and modeling, we first evaluate the signal-to-noise-plus-interference ratio (SINR) coverage probability and then derive the EE of the network as a function of the BSs' tilt angle.

We solve the above problem for two different scenarios. In the first scenario, a homogeneous network is studied where multiple macro base stations (MBSs) serve a number of macro-users. Applying the SG technique, we compute the coverage probability and the EE of the network. Afterwards, the optimum tilt in practice they encounter some challenges including high path loss, high power consumptions and the blockage effect caused by buildings and human bodies [3]–[5]. Another emerging technique in 5G wireless networks is 3D beamforming (3DBF) which utilizes active large antenna arrays to control the antenna patterns in a 3D space

[6]. In fact, in the 3DBF more degrees of freedom are exploited to adjust the beam patterns in both horizontal and vertical (tilt angle) domains to improve the network angle that maximizes the EE is found through an optimization problem. Because of the complex form of the objective function, this optimization problem is hard and can not be solved efficiently. The optimal value is then obtained by exhaustive search over the available range of tilt angles. In order to reduce the complexity, we propose an efficient algorithm based on bisection method which has a close performance to the exhaustive search but with a considerably reduced complexity.

The second scenario that we examine in this paper includes a two tier heterogeneous network (HetNet) composed of multiple MBSs and femto base stations (FBSs) which are modeled by two PPPs with different densities. To limit interference, we define a sleep region around each MBS so that the FBSs in the sleep regions do not transmit any signal. Using this idea, the coverage of the network is evaluated and the EE is calculated.

Then, the MBS tilt angle and the radius of the sleep regions are jointly optimized through an optimization problem for maximizing the EE. We also propose an efficient method which considerably reduces the computational complexity. It is shown that the proposed efficient method has only a small degradation in the performance with respect to the optimal solution obtained by exhaustive search. In addition, in the second scenario, we provide a lower bound on the coverage probability.

In 5G networks, the transmission based on high directional beams will be widely used, thanks to the wide deployment of mmWave antenna arrays [8]. At the same time, a huge energy consumption caused by large-scale antenna arrays is also incurred, especially for D2D links. Different from ground BSs or UAV-BSs, which have a stable energy supply, D2D devices equipped with massive antenna arrays are prone to suffer energy shortage. In addition, with the rapid increase of data traffic, the energy consumption of D2D devices has become a major concern in the industry, and the Energy Efficiency (EE) of D2D links needs to be urgently optimized. In this case, EH emerges as a promising way to increase the EE of D2D links by providing continuous energy supply for devices and sustaining the stability of links. Equipped with Radio-Frequency (RF) energy harvesters, D2D links are capable of harvesting energy from ambient RF signals while receiving information data. Not only the desired signal, but the interference and noise can be utilized to perform energy harvesting. This extends the battery life for devices and prolongs the communication period for D2D links, which is also beneficial to the improvement of the network EE. In this paper, we considered an EH-enabled D2D underlying UAV-assisted network scenario, where Simultaneous Wireless Information and Power Transfer (SWIPT) is adopted at the UAVs to enable the transmission of information and energy for ground devices. High directional beams were adopted for Air-to-Ground (A2G) and D2D transmission. While the CUs are receiving the information from the UAV-BSs, D2D transmitters are capable of harvesting energy from the A2G signal. We adopted the EH-BA-DT protocol [9,10] for DUs in EH-enabled scenarios. The system time was divided into the EH phase, Beam Alignment (BA) phase, and Data Transmission (DT) phase. As known to all, the network EE is closely related to the user rate and energy consumption. Therefore, to achieve the maximal EE, a tradeoff between increasing the data rate and decreasing the consumed energy is required. In our scenario, the interference issue was complex, which greatly affects the network EE. Misaligned beams will cause severe interference among users, which will also impact the EE of D2D links. In addition, due to the proliferation of mobile devices and the ever-increasing network traffic, data transmission and signaling exchange quickly consume the energy of D2D links, which makes the limited battery capacity of D2D devices easily depleted. To tackle this problem, an effective method is to alleviate the interference and increase the network EE by performing the joint optimization of beamwidths, transmit power, and EH time ratio for D2D pairs.

The beamwidth of the DU is an important factor affecting the user rate and energy efficiency. For the beam-enabled D2D users, the beam alignment process is first executed to determine the best-matched beam pair at the transmitting and receiving side before the transmission process [11], which means a long beam alignment time will shorten the time for EH and DT, and vice versa. Especially for high-speed mobile users, the process of beam alignment needs to be performed repeatedly. Therefore, controlling the time complexity of beam alignment is helpful to improve the transmission efficiency of the system. Although Exhaustive Search (ES) and Particle Swarm Optimization (PSO) can achieve excellent performance in beam alignment, the time complexity of the algorithms is too large to be effectively applied to the actual network. Therefore, to fully unleash the potential of the mmWave D2D link, it is of great significance to obtain the optimal/sub-optimal beamwidth in a short time to improve the network performance.

Besides, EH emerges as a promising technology to increase the EE of users relying on wireless charging. In traditional low-frequency scenarios, wireless charging has not shown great performance due to the low received signal strength. In 5G mmWave links, multi-antenna system can be employed at the transmitter to achieve effective RF energy harvesting through the enhanced transmission gain brought by beamforming. The authors in

[12,13,14] verified the feasibility of the combination of EH and mmWave technology. Although the optimization of the network EE in EH-enabled low-frequency scenarios has been widely studied, there still is a lack of an effective method to improve the network EE in mmWave scenarios. Hence, in this paper, we applied EH to mmWave D2D links and aimed to enhance the battery life of the links by increasing the network EE. When a D2D link selects a large transmitting and receiving beamwidth, the beam-sweeping process is carried out in a large-angle manner, which will reduce the beam alignment time and increase the time for EH and DT. However, a large transmitting beamwidth will possibly degrade the performance of other links, and a large receiving beam will suffer more serious interference. On the contrary, reducing the transmitting and receiving beamwidth is beneficial to mitigate potential interference, but the time of the BA phase will be greatly prolonged because a huge number of pilot signals are needed to align the beams, which will shorten the time for energy harvesting and data transmission and degrade the system performance.

Moreover, for D2D links, the power and EH time ratio have a significant impact on the network EE. The transmit power not only affects the user's achievable rate, but also the rate of other D2D links and the overall energy consumption. Therefore, the transmit power for DUs will have a complex impact on the network EE and needs to be optimized. Similarly, the network EE is also closely related to the EH time ratio. Fixing the BA time ratio and increasing the EH time ratio can increase the energy harvested, but this will also reduce the effective transmission time, and vice versa. Moreover, the performance of CUs should be protected by controlling the interference from DUs to CUs.

In this case, to improve the network EE, the three coupling variables, beam width, transmit power, and the EH time ratio, need to be considered comprehensively. In this paper, we propose a joint optimization of beam width selection, power control, and the EH time ratio to iteratively optimize the variables while fixing the other two. First, a low-complexity beam width selection scheme was designed to allow users to find the optimal/sub-optimal beam width in a short time. Specifically, DUs first form coalitions to choose different beam widths. Then, the coalitions are continuously updated along the direction of improving the network utility (i.e., EE) until the final Nash equilibrium is reached. Next, a power control method was designed to suppress the interference and improve the EE. The power levels of D2D transmitters were optimized using the Dinkelbach method and SCA to obtain the sub-optimal power for DUs. Finally, the optimization of the EH time ratio was executed to further improve the EE. The EH time ratio was optimized by solving the convex linear fractional programming. The network EE was iteratively updated until reaching the convergence point. In conclusion, the main contributions of this paper can be summarized as follows:

Different from existing research, we considered a downlink scenario of EH-enabled D2D underlying a UAV-assisted mmWave network and took into consideration the complex interference issue. We built an efficient framework for improving the EE of D2D links by jointly optimizing the beamwidth, transmit power, and EH time ratio of the D2D links using alternating optimization, while guaranteeing the rate requirements of CUs and DUs. The proposed algorithm has low computation complexity and is applicable to large-scale mmWave networks; We constructed a coalition game model to solve the beamwidth selection problem for D2D users, which can explore the potential beamwidth combinations of DUs and converge to the beamwidth structure with sub-optimal utility. A low-complexity beamwidth selection algorithm was proposed to adjust the beamwidths of DUs for increasing the network EE;

The transmit power of D2D links was optimized to further improve the system EE. The original non-convex problem with regard to power optimization was solved by non-fractional programming and successive convex approximation. Specifically, we first transformed the non-convex fractional programming into a non-fractional problem using the Dinkelbach method. Next, we eliminated the non-convexity in the formula by approximating the non-convex part with its first-order Taylor expansion. Along with the power, we also optimized the EH time ratio. The problem with regard to the EH time ratio was proven to be a convex linear fractional programming, and hence, the optimal solution is readily obtained. We validated the convergence and effectiveness of the proposed algorithm by performing numerical experiments with different settings for the network parameters. The proposed algorithm can converge to the optimal EE after finite iterations and effectively improve the network EE compared with the Fixed Beam width and Fixed Power (FBFP) scheme. Our proposed algorithm can achieve performance close to ES and PSO, but with much reduced complexity. The factors that potentially affect the network EE, such as the number of DUs, the number of CUs, the maximal power for DUs, the minimum harvested energy, and the minimum rate for CUs, are also thoroughly discussed and analyzed. In addition, we assumed that data collection and algorithm execution were performed at the Operation And Management (OAM) in the gateway. We assumed that the coverage of the UAV is determined based on the path loss threshold [35], and the association between UAVs and users was established based on minimum path

loss criterion. In addition, we ignored the movement of UAVs and users and assumed all the UAVs hovered at a fixed horizontal position and fixed altitude. However, our algorithm can also be utilized in a dynamic and fast-changing environment since the time frame can be approximately divided into multiple snapshots, in which our system model and algorithm can be applied.

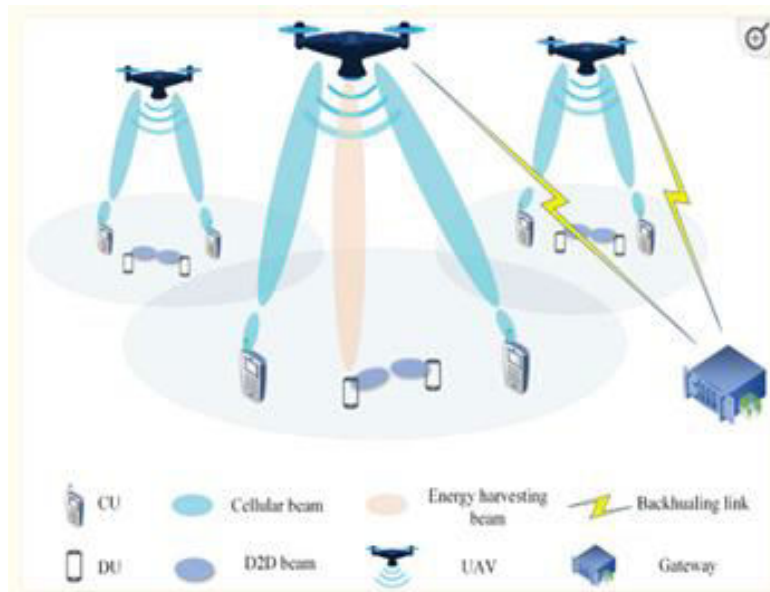


Fig.1 Network architecture.

CONCLUSION

This paper has discussed the concept of a Energy Efficient Techniques of 5G Millimeter-Wave Cellular Access Networks analyze the coverage probability Wireless Networks adaptive HBF MIMO systems that adapt their behaviour on a frame-by-frame basis to optimize EE. In particular, a DM based solution has been studied to enable fractional programming to maximize the EE of the candidate transmitter and receiver architectures in a low-cost manner. The DM method described in this paper can achieve EE and SE performance similar to the exhaustive search based BF approach, while reducing the complexity significantly. Once the number of RF chains is selected, the proposed technique needs to compute the HBF matrices only once. Further, the DM solution can also provide significantly improved EE performance.

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A TECHNICAL ASSESSMENT OF PNEUMATIC CONVEYING OF RICE HUSK WITH RESULTS FROM A CONVEYING FLOW LABORATORY TEST

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A conveying system of any kind is used to transport a material from one source place to destination or receiving place. For the chosen method of pneumatic conveying, air is used as the transport medium. It is applicable to most fine powder to granular materials, be they in that form naturally or have to be pulverised or crushed. In this system, energy is needed to accelerate the material from rest, to lift it as required and to overcome the losses due to friction.

Rice husk is by-product which results from paddy, the husk is removed by friction as the paddy grains pass between two abrasive surfaces that move at different speeds. It has been used as building material, fertilizer, insulation material, or fuel. Combustion of rice hulls produces rice husk ash (RHA) which is a potential source of amorphous reactive silica. Most of the ash is used in the production of Portland cement. The ash is a very good thermal insulation material.

Rice husk though been not easily transportable material, however, certain operational sequences, precautions at feeding zone and with sufficient motive force (flow and pressure) rice husk can be transported which was resulted in Conveying Flow lab tests. Rice husk has high silica content and is abrasive, the conveying velocities are keen to investigate. This paper explains the setup used for this trials, characterization of material used as feed, conveying parameters achieved.

Acknowledgements: *Author acknowledges the resources usage and directions to organize the data and analysis from In-house infrastructure. The co-authors are deeply acknowledged for their contribution is data preparation, discussing the variations to put up a comprehensiveness of the paper in logical fashion.*

Keywords: *Conveying Systems, Rice Husk Lean phase Danse phase trial*

Pneumatic conveying is often the perfect solution for the conveyance of dry powder form materials: overpressure and under pressure create a fast air flow inside the pipelines, which transports the material directly to the desired destination location. There are variety of differentiation of conveying system, however will detailed below Lean Phase – Pressure based Conveying and Lean Phase – Vacuum based Conveying.

This paper tries to establish the parameters with appropriate type of pneumatic conveying system for Rice husk and at same time to study feed rates achieved without conveying line choking.

In lean phase conveying, particles are fully suspended in the conveying air and transported at low pressure and high velocity. Lean-phase pressure conveying is one of the most common conveying methods for powders or granules. It's most often used with non-abrasive, nonfragile materials that have a light bulk density. The positive pressure system is the most extensively used configuration in pneumatic conveying. These systems are well suited to multiple discharge applications in which material is picked up from a single point and delivered to several receiving bins. The change from one bin to another is usually effected by means of multiport diverter valves. By virtue of their operation, positive pressure systems require feeding devices which can introduce the material which is normally stored at atmospheric pressure into a pressurized line.

And, negative pressure systems are used for the transport of material from several feeding points to a common collection point. Since the operation involves the employment of positive displacement blower systems of various kinds, such systems are limited in distance and capacity. Negative pressure systems are extensively used in the conveyance of toxic and hazardous materials. These systems permit dust-free feeding and provide an additional safety feature in as much as any leaks in the pipe will not result in polluting the environment due to an escape of material. Fig 1 is lean phase – Vacuum conveying system.

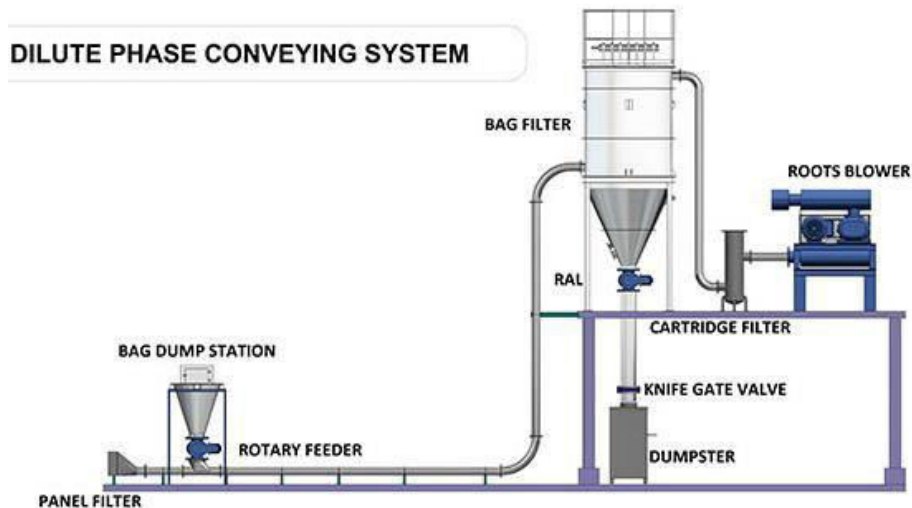


Fig 1: Lean Phase Vacuum based conveying system.

Test Trail setup:

Rice husk conveying tests been conducted on the existing setup at Conveying Flow Lab. The feed station having opening for bags discharging, fed the rice husk as received and discharge via rotor valve. The negative pressure (Vacuum conveying) conveying been setup for this application.



Fig 2: Feed station and Discharge valve



Fig 3: Collecting filter

At first, fed the material in feed station through batch wise as can see in fig 2. The bin mounted vent filter which filters lighter density material and heavy density material after feeding all the material into the hopper. Material discharges to the conveying line via RAL. With provided vacuum to convey material system, pipe size that was used for experiment as 80NB and the total conveying length is about 60 meters.

Material that used was Rice husk which has moisture of appx 30%. Viewing from sight glass to see the conveying material to observe flow patterns can be observed via sight glass and conveyed fines material were at collecting filter and then collected at collecting hopper.

As there is 30% moisture in rice husk, initially fed the material dumped, simulating the site conditions where usually by means loaders will dump the rice husk for transportation. While doing so, observed the material sticking inside the rotary air lock and jamming occurred.

This led to conduct the flowability test to record the flow properties of rice husk.



Fig. 4 Feed material, Rice Husk as-is received.

Trial Material properties -

Name- Rice Husk

Bulk density – Loose = 79 kg/m^3 , Tapped- 98 kg/m^3 Moisture content-

Angle of repose- 45 DEG

Trial Conducted-

We use Dilute phase conveying for Rice husk trail

Qty of Feed Material Received = 8.5 kg

Qty of Feed Material Conveyed = 8.5 kg

Particle size - (+5 MESH= 19%), (+ MESH= 26%), (+10 MESH=35%), (+20 MESH=76%)

Initial Pressure/ Vacuum (MMHG) – 120 bar Capacity that we achieve- 8.5Kg

Ambient temperature – 30 C Total Conveying length- 60 m



Fig: First dump feed (simulate site), choked



Fig : Flowability test rig

Trials: dumped all material into the feed station. Then material got choked in hopper and not able to discharge.

RESULT

Rice husk which is having many usages as mentioned earlier, in order to convey material through dilute phase system one should design the hopper discharge system with valve size relatively bigger so it will discharge smoothly. The Vacuum conveying method gives better results due to silica issues in the feed material rather than pressure and any other mode.

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CHANGING DYNAMICS AND TRENDS OF ENTREPRENEURSHIP

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Maharashtra College of Commerce, Pune**ABSTRACT**

Entrepreneurship is a transformational megatrend of the 21st century which holds capacity to redesign economies and industries. The aspect spurring entrepreneurs between traditional and rapid growing market is opportunity to implement creativity and necessity to deal with distinctive set of problems. The evolution of entrepreneurship has given freedom to individuals to implement their unique ideas without trying to fit in the traditional defined framework. The old beliefs that just new innovative idea will lead to a successful business, need of large capital and larger set up to start a business etc are notions which can no longer decide the fate of entrepreneurs. With digital revolution and ever changing demand, entrepreneurship has changed its course to fit the suitability for all necessities. Not every entrepreneur has to innovate something new, but redesign something in existence to fit the need of the hour. In today's market, we see entrepreneurs referred with unique neologism such as Edupreneurs, Knowledgepreneurs, Digipreneurs, Mompreneurs, Techpreneurs, Ecopreneurs, and Homepreneurs etc which are used to identify these entrepreneurs. These trends complements to entrepreneurial dynamism. The paper aims to identify the emerging new terms of entrepreneurship by defining new neologism trending in the field. The researcher will identify their unique characteristics. The researcher will use phenomenology as the method of research and study the interviews, panel discussions and presentations of these entrepreneurs which are available on online platforms and describe the case studies. The common traits will be identified to summarize and present in the form of conclusion of this research paper. Entrepreneurship these days requires greater specialization to maintain a competitive edge, therefore this paper useful for budding entrepreneurs to inspire them to take up entrepreneurship as a career option and motivate them to endeavor in their uniqueness.

Keywords: Entrepreneurship, entrepreneurial dynamism, entrepreneurial trends.

INTRODUCTION

Entrepreneurship is rising as a promising transformational megatrend of the 21st century which has capacity to reshape economies and industries throughout the world. As key drivers of economic growth, entrepreneurship is considered as the lifeblood of any economic growth, generating jobs opportunities, introducing new products and services essential to people's need, and promoting both greater upstream and downstream value-chain activities. India also has accepted this to re-route its growth story when other countries and economists pointed out that entrepreneurship can act as the catalyst for growth. Even after seeing many ups and downs throughout the history of our countries development, we started moving towards its direction by re-defining and re-enforcing entrepreneurship. To this date, we notice the social attitude and stigma about business and business owners is negative to some extent. Business is assumed to be successful only by using one or more shortcuts. As a result, there is shortage of social support to the youth and lack of adaption to new ideas put forward by them. Entrepreneurial Skill is not an inherent ability; it is also a result of condition. To be effective, a business visionary needs to stay dynamic and capable to the existing environment. The entrepreneur cannot be kept distant from the dynamic social qualities, new developing advances, and customer needs. The social elements practice has a solid impact on the character of the people opting for innovations. Along with the social blend, technical advancement grants a significant impact in the development of an entrepreneurial aptitude and improvement.

In past years, the concept of entrepreneurship has witnessed exemplar shift in its trends and dynamism, with Micro, Small and Medium enterprises playing a vital role in economic and social development. According to the Organization for Economic Cooperation and Development, MSMEs on average contributes around 50% or more to the GDP; provides employment to an estimated 60% of the local workforce; creates up to 70% of new job opportunities; and accounts for about 30% of exports. The factors spurring entrepreneurship are out of opportunity and necessity. Due to the event of strong entrepreneurial structures offering access to capital and tax frameworks, mature markets, progressive and impactful startups that have the power to disrupt existing industries and create entirely new ones, or at least new market segments. Markets are opening to observe high impact entrepreneurs. Youth are motivated and trained for gaining relevant entrepreneurial competencies; concepts of incubation centers at higher education and school level are promoted. According to the Global Entrepreneurship Monitor, Women entrepreneurs are initiating and managing new businesses at a tremendous

fast pace with 5 million worldwide plan to grow to at least 6 employees and 126 million are leading new enterprises in 67 countries around the world.

Governments and markets are exploring a range of financing strategies to provide capital to entrepreneurs, including micro financing, crowd funding and credit guarantee schemes. Shortage of financial support is one of the primary reasons for business to end their activities along with losses faced by them. As entrepreneurial businesses grow and develop, the source of finance they rely on change. The era of a magnificent mechanical age with artificial intelligence has given a winning edge to its users not only in production processes but also in the services sector like health, education and law. Business moves are now strategized and has become information based. Disruptive technological advancement has taken the limelight. The initiatives like 'AtmaNirbhar Bharat' and 'Vocal for Local' sought to create ripple effect in the revival process post pandemic. In today's market, we see entrepreneurs referred with many unique neologisms such as Edupreneur, Knowledgepreneurs, Digipreneurs, Mompreneur, Techpreneurs, Ecopreneurs, and Homepreneurs etc which are used to identify these entrepreneurs.

OBJECTIVES

1. To study the changing dynamics of entrepreneurship
2. To define the concepts of Edupreneur, Knowledgepreneurs, Digipreneurs, Mompreneur, Techpreneurs, Ecopreneurs, Techpreneurs and Homepreneurs
3. To understand the characteristics of Edupreneur, Knowledgepreneurs, Digipreneurs, Mompreneur, Techpreneurs, Ecopreneurs, Techpreneurs and Homepreneurs
4. To assess the common traits identified and summarize them

RESEARCH METHODOLOGY

The study is descriptive type. The researcher has used case study research method and phenomenology as the method of research and studied the interviews, discussions, online presentations which are available on Youtube, print media and websites. The researcher studied such entrepreneur from each of these online cases along with entrepreneurial case studies available on print media.

WORKING DEFINITIONS

Entrepreneur – Entrepreneur is a person, who attempts to create something new, organizes production activities and undertakes risks and handles uncertain challenges involved in the enterprise.

Homepreneurs – Homepreneurs is defined as a business owner doing business from home. Homepreneurs are entrepreneurs who carry out business from their home.

Edupreneur – Edupreneur is person who creates a positive value shift with the specific economic resource of learning.

Knowledgepreneurs – Knowledgepreneurs can be defined as people creating opportunity or taking action to create innovative knowledge practices or product.

Digipreneurs – Digipreneurs are entrepreneurs focused exclusively on digital commerce.

Mompreneur – Mompreneur is a term used to describe women who start or run their own businesses while also acting as a full-time parent.

Techpreneurs – Techpreneurs can be defined as an entrepreneur who starts and manages their own technology business.

Ecopreneurs – Ecopreneurs are entrepreneurs whose business efforts are not only driven by profit, but also by a concern for the environment

EDUPENEURS AND KNOWLEDGEPRENEURS

The term 'edupreneur' is the combination of words 'educator' and 'entrepreneur.' Educator is defined as person who educates or is a key role player in educating others and entrepreneur is a person, who attempts to create something new, organizes production activities and undertakes risks and handles uncertain challenges involved in the enterprise. Therefore, an edupreneur is person who creates a positive value shift with the specific economic resource of learning. Therefore we can describe an Edupreneur as an individual who wants to form an optimistic value shift with precise economic sources of education and learning. Forbes defines "edupreneur as an entrepreneur who works within in the education sector". They are highly motivated with their mission and exist to bring forth positive impact on education and learning. They can be found building new

education organizations and businesses, developing the latest edtech tools and running new schooling platforms. Therefore it can be said that educator is person whose mission is to bring positive impact in education organizations, person who dedicates self to design, develop and deliver education to segment of the society.

Knowledge entrepreneurship can be explained as the capability to identify or generate an opportunity and take obligatory actions meant to realize an innovative comprehension of practice or product. Knowledge entrepreneurship is different from 'traditional' economic entrepreneurship as it does not aim at the realization of monetary profit, but it solely focuses on chances with the objective to improve production and throughput of knowledge with personal transformation of learners rather than capitalizing on profit. Knowledgepreneurs can be defined as people creating opportunity or taking action to create innovative knowledge practices or product. It has been disputed that knowledge entrepreneurship is most appropriate form of entrepreneurship for educators, researchers and educational institutions with goal of creating impact on learning rather than aiming for monetary profits.

Characteristics of Edupreneurs and Knowledgepreneurs

Edupreneurs mission is to create positive impact for their learner. Their mission is not just to succeed in earning money but to bring long term change for learning and development of students. This is very critical for an edupreneurs and knowledgepreneurs to be innovative. Innovation is not only creating new ventures like other existing in the market but they have to come up with activity-based education to impart knowledge, effective solutions to cope up with the problems and situations. For idea to be more effective, right platforms for the right audience are very crucial. Limiting to only online learning could negatively impact overall personality development. Edupreneurs also aim to create right collaboration with the group having the type of knowledge.

ECOPRENEUR

Ecopreneurship is used to characterize principles of entrepreneurship applied to create industry that aim to solve environmental problems. In the book *Merging Economic and Environmental Concerns through Ecopreneurship*, written by Gwyn Schuyler in 1998, ecopreneurs are defined as follows: "Ecopreneurs are entrepreneurs whose business efforts are not only driven by profit, but also by a concern for the environment. Environmental entrepreneurship is turning into extensive market based approach to seize the opportunity of improving environmental quality along with earning profits. Activities the ecopreneurs work on are wide spread from recycling of food waste to ocean pollution with innovating ideas the curb these environmental issues.

Characteristics of ecopreneur

Ecopreneurs are centered on resolving the issues society is facing through the businesses they create, greening is the main goal of their business. Ecopreneurs focus on support and partnership than competition as the way to grow in the world. Therefore many form partnerships or creative interdependencies with fellow Ecopreneurs with similar principles. Ecopreneurs take an inclination for innovation and applying it to significant purpose. They glorify the re-greening of Earth, restoring degraded land, cleaning the air, building healthy and safe homes, devising clean, renewable energy sources, offering prevention oriented alternatives to treatment focused healthcare and helping preserve or restore the ecological balance. While entrepreneurs generate money work through the businesses, or assets they mount up, ecopreneurs utilize their businesses to put into service to their unique Earth Mission.

TECHPRENEURS

Techpreneur can be defined as an entrepreneur who starts and manages their own technology business. It comes from two words, technology and entrepreneur therefore it means a business that uses technology as their business model. A techpreneur can be described as an entrepreneur who designs a solution with the use of technology to seize the opportunity in the present market, improve a traditionally done activity with technology to reduce the challenges in the current system creatively. Technopreneurship is a new class of entrepreneurship. It involves coming together of intelligent people, driven, creative, tech-savvy, and passionate, and desire for calculated risk. Techpreneurs are successful when their teams function together as it is considered to be a costly venture with distinctive challenges. Therefore it's essential they direct, guide and inspire their team members, create funds by presenting their idea to sponsors. For this reason, past work experience and networking are favorable for Techpreneurs.

Digipreneurs can be defined as entrepreneurs exclusively centered on digital commerce which is a division of e-commerce for companies that create digital products and services, completely running their businesses online including marketing, delivering products and services online. E-books, memberships, software to download, web hosting, learning platforms etc are examples of digital commerce. If digital entrepreneurs are focusing on digital products and services that are marketed, delivered, and supported completely online, then it stands to reason a good website is a prerequisite for success.

Characteristics of Techpreneurs

Techpreneurs need to have technical knowledge of their product or service, need to understand the underlying technology used. Though the experts will develop the product, techpreneur needs to guide them with their exact thought and understanding behind the product. Therefore, communication skills to put across the exact idea, thought and understanding in clear and precise manner to multiple stake holders is utmost important for techpreneurs. Not only must one regularly communicate with people looking to invest and inspect concept, but also with team looking to grasp at the more specific aspects of product and achieve the vision. The success of the techpreneurs is not limited to them but depends on the team. It is no wonder that many corporations fail and face losses due to unsuitable recruitment and team strategies. Therefore is it up to Techpreneurs to build a team with experienced, skilled, hard working team. Another important aspect is to build a unique, good quality product or services which surpass the existing competition in the market.

HOMEPRENEURS

Homepreneurs are business entrepreneur who operates from his or her home. Collins dictionary defines homepreneurs as “an entrepreneur who creates and manages a home based business”. Though there is no formal definition by the government but it can understood that homepreneurs manage their business operations from home. They can utilize any spare room, kitchen, garage, living room or available area as an office to operate business activities. This is a great prospect for those with limited resources, to work with reduced operating expenses, test and incubate their products and services, reduce the risk in investment and zero commute which in turn saves time and money. It also gives homepreneurs the space to work in a safe environment, especially for women. Also helpful for those individuals who want to maintain a flexible working schedule to adjust with their household and family needs and keep a successful work and home balance.

Characteristics of Homepreneurs

Characteristics of homepreneurs are no different than the essentials for entrepreneurs. Homepreneurs are driven individuals with a business idea; they are disciplined and focused on their business work. They are confident and knowledgeable to make their businesses succeed. They are innovative; they analyze every event and situation to proceed vigilantly. Homepreneurs are creative, come up with solution for every bottleneck and use their resources efficiently. Homepreneurs are always multi tasking, they are skilled with efficient management practices, they utilize the available resources, whether it is time, space, raw material or money, they efficiently consume the resources with zero wastage. Homepreneurs are risk takers. They take calculated risks which is an important aspect of homepreneur. Homepreneurs are customer oriented. They understand the importance of customer satisfaction and which therefore drives them to maintain fine quality product and service. Finally, homepreneurs are passionate. Their business is the extension of their personality, ethics and this is what helps them to be self motivated and drives them forward.

MOMPREENEURS

Mompreneur is a term used to describe women who start or run their own businesses while also acting as a full-time parent, mompreneur is an amalgamation of the words "mom" and "entrepreneur." Because of family obligations, mompreneurs have to balance the requirements of running a business with the responsibility of raising their children. There is no set working hours for them and they may do the bulk of their work during the time when their children do not require as much attention, such as when they are at school. Most of the time, mompreneurs are mothers who are running small scale operations out of their own homes, such as selling crafts on sites like Etsy, eBay or Meesho, rather than those founding high capital ventures. Women entrepreneurs are a rising trend with successfully balancing work and family obligations. This is positive sign that the startups space is becoming more unrestricted. Mompreneurship is a new trend in entrepreneurship and has come to increased prominence with the Internet allowing entrepreneurs to sell products out of their homes.

Characteristics of Mompreneur

Worklife balance is a crucial aspect of being a mompreneur. Because of family responsibility, they have to balance the requirements of running a business with the demands of raising their children. Activities are carried out with a flexible schedule. Use of digital platforms, social media and internet are sources to sell their products. Also, we can see them working from their home instead of applying big investments and huge ventures. They are customer oriented, they understand the importance of customer satisfaction and which therefore drives them to maintain fine quality product and service. They multitask to showcase their products on digital platforms and they handle the marketing, ecommerce, and transactions all the way through.

CASE STUDIES

Vamsi Krishna founded Vedantu, a leading online tutoring company to create a platform for online live lessons. Vamsi is n alumnus of IIT Mumbai, he also founded Lakshya Institute, a renowned test preparation

brand in North India. Vedantu's revenue has been anticipated to be \$2.7 million. Lakshya Institute makes more than Vedantu by \$1.2 million. **Shantanu Prakash** is perhaps India's first Edupreneur, founded Educomp Solutions in 1994 to digitize schools with computer labs. The company is branded for edtech products from educational content to toys, interactive media, smart hardware, and more. **Byju Raveendran** is the founder of Byju's, a popular premium learning app. He completed his education from an engineering college in Kannur, Kerala. His parents were teachers. Byju's is India's largest ed tech company which offers online learning, one on one guidance, dedicated mentors etc.

Dipali Mathur Dayal, co-founder & CEO, Super Smelly. She launched the business in 2018 and deals in personal care products for Gen Z that are made with natural ingredients and are toxin-free. Dipali actively manages brand management, investor management, product vision, strategy and course for the company. She is a parent and carves out time to spend with her family along with successfully managing her professional commitments. **Ghazal Alagh**, co-founder, MamaEarth, started her venture in 2016 with her partner to make toxin-free baby products like bamboo-based wipes after their son himself faced the side-effects. MamaEarth is at par with European standard of safety and it restricts the use of three thousand known toxins. **Nidhi Batra**, co-founder, Nirvana Excursions launched Nirvana Excursions in 2013. It specializes in customized solutions with unique travel experiences. As a working mom and mother to two kids, she has a very busy schedule but also takes out time to read to her kids or to travel together.

Priyanka Sharma founded "Grow Green Happiness" as a platform to share their passion for plants with like-minded people. She is striving to help people rekindle their love and fondness for nature by creating a house that's filled with happy plants. **Priyanka Amar Shah**, founder of iKheti is an avid nature lover, started iKheti in 2011 to empower people to practice sustainable urban farming. It is a full-fledged eco-friendly enterprise that promotes farming among city dwellers and offers workshops, consultancy and gardening resources. **Preeti Narula**, founder of Living Balconies, started the business in 2013. Living Balconies showroom caters to all gardening needs, from gardening tools and products, gardening tips to create green home and garden makeovers. Living Balconies is an online project committed to creating green spaces which are beautiful and refreshing customers. They bring nature's green in their homes and offices. **Dipti Jhingiani**, founder of Let's Be Outdoorsy, conducts film festivals about India's outdoors, conducts green workshops and hosts talk shows with celebrated athletes like open water swimmers, triathletes, mountaineers and nature lovers to inspire the outdoor spirit. **Mansi Shah**, founder of GiftGreen, was disturbed seeing the hundreds of national flags thrown to the ground after the Independence Day celebration. To solve this issue, she initiated an attempt to reprocess flags with GiftGreen and decided to begin seeds into the throwaway flags. The objective was to emphasize the need to protect the environment as well as the dignity of the national flag. This venture, GiftGreen, seeds the handheld flags they create and encourages planting them after the celebrations and see it grow into a plant. The idea was to teach children the need to save the environment with the belief awareness can help the world go green.

Priyanka Gusain created Zubiya in 2013, she completed her Bachelor degree in Commerce in 2012. She is an artist and sells hand-crafted and painted shoes, jackets, scarves, wallets and clutches. Using software as a service (SaaS) via KartRocket, she created a website Zubiya.com. It is an inexpensive way to launch and has in-built payment options, brand-building and logistical support. She had a passion for fine arts and wanted her brand to reflect that fervor for colors and quirky patterns. Products are hand-painted with giving local village tailors employment to stitch the fabrics. Footwear is hand-painted with waterproof acrylic colours. Products sold by Priyanka are handmade and unique. Priyanka has face book page named Crafted by Zubiya, with various product information and LinkedIn Page where she post updates regarding latest collections. Social media and digital marketing plays an important role to pursue her dreams. **Priya Harjai** was born and raised in Mumbai. She was a web designer for 12 years before choosing to quit her job for motherhood. She didn't want to be a homemaker and was interested in art & craft. She creates handmade designer wooden boxes, jewelry boxes and multipurpose gift boxes. Each box is beautifully designed and a piece of art on its own. She started Olive by Design in 2015 via Shopmatic. While the offline store got 25 orders a month, queries from prospective buyers increased after she launched the e-store. **Zahra Khan** is a professional makeup artist, hairstylist, fashion stylist and got certified from VLCC and L'Oreal. Her passion for makeup and fashion inspired her to become homepreneur. She has a parlor setup in a spare room at home. It is beautifully designed and has all the facilities available. She has gained loyal customers via Instragram. She posts photos & videos of her work on Instragram and attracts customers online. She also creates homemade shampoos, unique per customers need and demand. She even uses GooglePay and Paytm for payment transactions.

Satish Kannan, Co-Founder and CEO of DocsApp, envisioned the need for a safe and online consulting platform where doctors and patients can communicate without worrying about privacy. Thus, in 2015 and

launched DocsApp, One of India's first online doctor consultation platforms, DocsApp has revolutionized the healthcare space by adding new channels of communication among patients and doctors. **Sabeer Bhatia**, founder of e-mail service Hotmail, Bhatia's e-mail service currently has over 369 million registered users. He started another venture, Arzoo, which is an e-commerce and started JaxtrSMS for free messaging service. **Harsh Pokarna**, CEO of OkCredit, found the digital accounting app OkCredit to resolve the issues encountered by the traditional bookkeeping method of small business owners. Their aim is to motivate the local merchants of the country to be technologically advanced by letting them manage all their monthly settlements of the customers and clients digitally. Established in 2017, there has been a tremendous growth of the app. The installed audience base was skyrocketed to almost 250% from August 2019 to March 2020. They have over 5.5 million active users currently who recorded transactions worth \$ 7.5 million. **Nikhil Joshi**, Founder, Digital Jalebi, offer commercial services and experiential engagements and designs. The major challenge was to get many types of talents. From individuals having an MBA, multimedia artist, electronic and computer science programmers, architects, graphic designers etc and have all of them on board to deliver projects.

It was a huge challenge to have so many talents aligned together to deliver smaller projects up in the initial stage of business but that has become their strength. The variety of talent they have in their team and the uniqueness proved out to be their biggest strength.

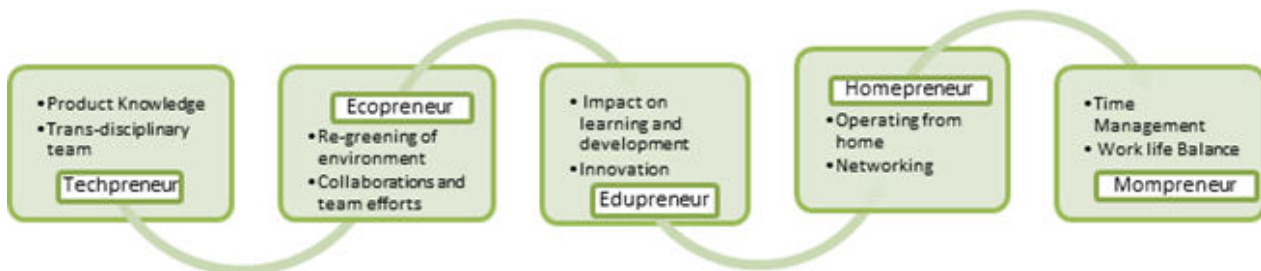
CONCLSION AND SUGGSTIONS

French economist Jean-Baptiste said that "The entrepreneur shifts economic resources out of an area of lower and into an area of higher productivity and greater yield." Therefore, it can said that entrepreneur assumes a level of risk in creating the shift of economic resources and seeks a return on their efforts, most commonly a financial return. There are many common characteristics these entrepreneurs share irrespective of the area of their business. Successful entrepreneurs are always curios that allow them to endlessly look for new opportunities and solutions to problems. Successful entrepreneur take decision which are difficult and stand by them. They are responsible for guiding the course of their business, including every aspect from funding and strategy to resource allocation. A successful entrepreneur is conscious of their strengths *and* weaknesses. They don't let shortcomings be a barrier; they build teams that complement their vision and capabilities. Launching a business enterprise requires to take risks, entrepreneurs take steps to minimize it.



While many successful entrepreneurs learn from failing, they know never to give up on their dreams. They see failures as opportunities to gain knowledge of situations and grow. Innovation goes hand-in-hand with entrepreneurship. Some successful startups drastically improved the existing product to meet the changing needs of the market. Social skill set is an arsenal with which an entrepreneur makes his business work and it's crucial to be a good entrepreneur. A good entrepreneur will always know business is all about the customer. It isn't necessary for every entrepreneurial venture to become a billion dollar company. In addition to a brilliant idea, viability is an equally important aspect of a business, which is where having business knowledge can play an important role. Let's discuss few unique aspects which differ based on the nature of business. For Techpreneur, product knowledge, excellent trans-disciplinary team and appropriate funding and working capital are key aspects. Ecopreneurs are focused on solving the problems society is facing through the

businesses they create, greening is their bottom line and collaborations with like minded groups are necessary for success. Edupreneurs want to create positive impact on learning and development by creating innovative and efficient learning platforms. Homepreneurs operate from home therefore networking and overcoming isolation will be their challenge areas. While Mompreneurs need to manage time effectively, optimum utilization with maintaining work life balance will be an absolute task.



Entrepreneurship is accepted to be an engine of growth across the globe with various policy initiatives over the recent years. Today profitable business environment is promoted by working on the factors that would help in ease of doing business on one hand and providing seed capital and other such loans on the other. Supportive environments are essential to successful entrepreneurship and are steadily evolving throughout the world to promote entrepreneurs. The ultimate entrepreneurial environment comprises five pillars: educational systems that support entrepreneurial mindsets; access to funding; entrepreneurial culture; supportive regulatory and tax regimes and a coordinated approach that links the public, private and voluntary sectors. Many rapid-growth markets are taking action in terms of the implementation of these pillars, and now boast projects across different sectors, consequently stimulating dynamic clusters of entrepreneurial activity. Given the influential role entrepreneurs play in economic growth, policymakers are actively promoting entrepreneurship opportunities that bring together both government and industry entities. The approach targets unemployed youth and educates them about potential entrepreneurial prospects, celebrating young entrepreneurial successes, promoting domestic startups on an international level, integrating media and cultural campaigns within a broader national strategy, and creating initiatives that offer alternative sources of capital. Government startup programs are most valuable sources of help. Governments are working to create institutions help entrepreneurs financially, meet their requirements for funds, motivation private investors to help start ups, improve tax incentives. Now more than ever before, it is fundamental that business leaders, governments and policymakers come together to support, encourage and advance entrepreneurship. It has proven to be indispensable to socioeconomic development worldwide, especially in a country such as ours that has massive entrepreneurial potential and depends almost entirely on MSMEs to grow its national economy.

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IMPACT OF MEDITATION ON BLOOD PRESSURE OF COLLEGE GIRLS

Brij Bhushan Singh¹ and Samiya Husain²¹Professor, Department of Physical Education, Aligarh Muslim University, Aligarh- 202002²Research Scholar, Department of Physical Education, Aligarh Muslim University, Aligarh- 202002**ABSTRACT**

The purpose of the present study was to investigate the effect of meditation training on blood pressure. Total 60 female subjects who were studying in Tikaram Degree College, Aligarh, were randomly selected for this study. Their age ranged in between 18-25 years. The subjects were divided into experimental and control group of 30 each. Blood Pressure of female students was selected for this study. For analysis of the data Mean & SD were calculated and to examine the effect of meditation on the resting blood pressure paired t-test was used at .05 level of significance. It was hypothesised that there would be a significant effect of meditation on the Blood pressure of college girls. Significant difference was observed in the pre and post experimental means of resting systolic blood pressure of training group. Insignificant difference was observed in the pre and post experimental means of diastolic blood pressure of control and training groups. It was concluded that meditation training caused significant change in the Systolic Blood Pressure.

Keywords: Blood pressure, meditation, college girls

INTRODUCTION

Meditation is a complex phenomenon that involves several coordinated, cognitive processes and autonomic nervous system alterations. Meditation as a form of therapy may facilitate positive effect resulting in a sense of physical and mental well being in patients. Meditation has entered the mainstream of health care as a method of stress and pain reduction. In the recent years there has been a growing interest within the medical community to study the physiological effects of meditation.

Blood Pressure (BP) is also a well-known fitness parameter for the physiological fitness of a player. It is well known that a hall mark of heart failure is adverse changes in autonomic function. Elevated blood pressure is a powerful predictor of congestive heart failure and other Cardiovascular Disease (CVD) outcomes. **Pal, Pravati (2014)**. High blood pressure (BP) is one of the most important modifiable risk factors for cardiovascular diseases, which accounts for one in every eight deaths worldwide. According to Merriam-Webster Medical Dictionary, "Blood pressure is the blood pressure on the walls of the blood vessels and, in particular, the arteries", usually measured on the radial artery utilizing a sphygmomanometer, and expressed in millimeters of mercury either as a fraction having as the numerator the maximum pressure that follows systole of the left ventricle of the heart and as the denominator the minimum pressure that accompanies cardiac diastole or as a whole number representing the first value only. It is measured in millimeters of mercury (mmHg), for example, 120/80, by a sphygmomanometer (**Morsi, Shukla, and Rathore, 2016**). (**Berge, Isern, and Berge, 2015**) concluded that there isn't a significant systematic difference between athletes and non-athletes. They further argued that strength-trained athletes have slightly higher blood pressure than endurance-trained athletes.

Various treatments can be applied to the hypertensive patients. Starting from pharmacological therapy using drugs - non pharmacological therapies such as herbal therapy, music therapy, yoga, acupuncture and meditation. Among these therapies, meditation is a non-pharmacological therapy that is best used for hypertension. Meditation is an exercise in the soul that can balance the physical, emotional, mental and spiritual that requires calm and deep appreciation. This meditation can give a relaxed and refreshing sensation both mentally and physically, able to control emotions, relieve stress, and control blood pressure (BP). This meditation can affect the central nervous system by relaxing blood vessels, making it easier for blood to flow and lowering blood pressure. Meditation is also able to balance the autonomic nerves which are responsible for helping the body maintain normal blood pressure.

OBJECTIVE

The purpose of the present study was to investigate the impact of meditation on the blood pressure of college girls.

METHODOLOGY

For the purpose this study sixty (N=60) female students were selected randomly from Tikaram Degree College, Aligarh. U.P. India. Their age ranged between 18 to 25 years. The subjects were divided into experimental and control group of 30 each. These subjects participated voluntarily in this programme and before the start, they

were examined by the physician to ascertain that they were free from any medical problem and were fit enough to undertake the meditation training programme for a period of three months.

HYPOTHESIS

It was hypothesised that there would be significant effect of meditation training on blood pressure of the college girls.

Training Programme

The subjects selected for the present study were divided into two equal groups called meditation experimental group, and Control group, each consisting of 60 female students in the age group of 18 to 25 from Tikaram degree college, Aligarh for twelve weeks of heart based meditation training was given to the experimental group. The time and frequency of meditation training was increased gradually from beginning to the end of the session. The control group was not to allow participate in any of the training program, except their classes. Measurements for the variable were taken at the beginning (pre-test) and at the end of the experimental period of twelve weeks (post-test) the data was collected for all the variables from experimental groups and control group.

Collection of Data and Administration of Tests

In order to acquaint the subjects with the specific purpose of the research being conducted, all the subjects were assembled in the field of Tikaram Degree College, Aligarh, All the necessary information pertaining to the requirement of the experimental procedure was imparted to them. To make the research findings more authentic, positive attitude towards investigation was emphasized.

The data for the physiological responses of college girls was obtained with the help of **Omron HEM- 7120 Blood Pressure and Heart Rate Standard Monitor supplied by Galaxy Informatics (India), Pen, Record Sheets**. The blood pressure (systolic and diastolic) was recorded in mm of Hg. The data on blood pressure were taken prior to the experimental programme. Pre-test data was collected two days before the commencement of the training program and post-test data was collected after the training procedure.

Blood pressure

The blood pressure of each subject was recorded in the morning session. The subject was asked to sit and relax comfortably on a chair avoid doing anything until the measurements were recorded. The investigator wraps the cuff around the arm by placing the arm on table so that the cuff will be at the heart’s level. Then press the start/stop button, and the cuff started to inflate automatically. When the measurement was done, the arm cuff automatically deflated. Blood pressure systolic/diastolic were displayed. No movement and talking were allowed while taking blood pressure measurements. The blood pressure (systolic and diastolic) was recorded in mm of Hg.

Statistical Procedure

For analysis of the data, Mean and SD were computed. The data was analysed using SPSS version 21. Paired t-test was applied to find the significant difference between pre and post experimental means. For testing the hypothesis the level of confidence was set at .05 level of significance.

DATA ANALYSIS

**Table-1: t- test
Systolic Blood Pressure**

Groups	Test	Mean	SD	SE Mean	DM	SE Mean Diff.	“t” ratio	Sig.
Meditation	Pre test	119.2333	6.51620	1.18969	6.63333	1.25806	5.273*	.000
	Post test	112.6000	4.99379	.91174				
Control	Pre test	117.5333	7.56914	1.38193	1.00000	.81509	1.227	.230
	Post test	118.5333	6.56392	1.19840				

*Significant at 0.05 level

$t_{.05} (29) = 2.045$

The above mentioned table represents the experimental group’s data in which training was given to the participants. The table shows a significant difference between the pre-and post-test mean scores. The obtained t is **5.273*** and the p-value is 0.000 ($P < 0.05$). On the other hand there exist no significant difference between the mean scores of the pre and post-test of control group. The obtained t is 1.227 and the p-value is .230 ($P > 0.05$).

Therefore it is determined that no improvement was observed in the systolic blood pressure of the control group.

Table-2: t- test
Diastolic blood pressure

Groups	Test	Mean	SD	SE Mean	DM	SE Mean Diff.	"t" ratio	Sig.
Meditation	Pre test	71.2667	7.13386	1.30246	.50000	1.17027	.427	.672
	Post test	70.7667	4.04017	.73763				
Control	Pre test	71.2667	8.66994	1.58291	.10000	1.21234	.082	.935
	Post test	71.3667	7.60437	1.38836				

*Significant at 0.05 level

$t_{.05}(29) = 2.045$

The above mentioned table represents the experimental group's data and control group's data. The table shows an insignificant difference between the pre-and post-test mean scores of experimental group and control group in diastolic blood pressure. The obtained t value for experimental group is .427 and control group is .082. Therefore it is determined that no improvement was observed in the diastolic blood pressure of the meditation group and control group.

DISCUSSION OF FINDINGS

The statistical analyses showed significant difference in pre and post test means of systolic blood pressure of experimental group after the treatment. The present study was supported by the study of, **Armaita, Aprihatin Y. (2019)** also confirmed an effect of meditation to reduce blood pressure in elderly of hypertension patients. Based on the results of this study it is recommended to provide health education to the elderly about non-pharmacological therapies that are easily carried out by the elderly in order to find out prevention and reduce the disease they suffer as well as check the disease from the nearest health service. **Goldstein, C. M., et al, (2012)** They also concluded that meditation techniques appear to produce small yet meaningful reductions in blood pressure either as mono therapy or in conjunction with traditional pharmacotherapy. Transcendental meditation and mindfulness-based stress reduction may produce clinically significant reductions in systolic and diastolic blood pressure. The results of the study are also supported by **Sharma and Tyagi (2011)** from their study where they did not found any effects on diastolic blood pressure after 4 Weeks specific training programme on table tennis players, through comparisons of means within the components and through the comparisons of means within the control group. **Uppal, K. A., (1980)** also conducted that interval training, fartlek training and slow continuous running for a period of ten weeks did not show any significant difference in diastolic blood pressure after exercise. Thus in light of the above discussion we can say that meditation training is effective for reduction in systolic blood pressure.

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WORKING CAPITAL MANAGEMENT AND PROFITABILITY OF STEEL COMPANY**¹Priyanga V and ²Dr. S. P. Mathiraj**¹Ph.D. Scholar, Department of Commerce, Alagappa University, Karaikudi²Professor, Department of Corporate Secretaryship, Alagappa University, Karaikudi**ABSTRACT**

The working capital managing is very important for the firm. Both the fixed and current assets plays vital role for organization success. The working capital of firm consist investments like cash and bank balance, inventories receivables and short term investments. Thus working is known to manage these current asset. In this paper the data has been collected for 2012-2013 to 2021-2022. To find the impact of working capital management on profitability of JSW Steel Company. The various ratios like Current ratio , Quick ratio , Debtors turnover ratio (DTR) and inventory ratio(ITR) are the independent variable and Operating Profit Margin is the dependent variable. This study is purely based on the secondary data collected from annual report of companies website. In this paper the author uses descriptive statistics and regression analysis to check the significant impact of working capital ratios on profitability. Thus working capital plays vital role in a company.

Keywords: Working Capital, Profitability, Current Ratio, Quick Ratio, Debtors Turnover Ratio, Inventory Turnover Ratio

INTRODUCTION

The word Working Capital money mandatory for sustaining day to day operations activities in business, included for procuring of raw materials, salaries ,rent and regular expenses.Net working capital that estimates the working capital efficiency portray the excess of current assets over current liabilities. The company may inject its funds for long and short run operation. The working capital efficiency explains the firms ability to confront short term financial obligations. Working capital is noticed as back bone for daily operations of company. The company consume it for primary purpose of business. As stated by IM Pandey the working capital concepts are classified into two i.e. gross working capital and net working capital. The gross working capital investments which are made in current asset , the current liabilities are not included in the total current assets and net working capital that are difference between current assets and current liability. As per this concepts company s investments in current assets are know as gross working capital concepts. The working capital management look up the management of current assets and current liabilities. The current assets are the those assets which are easily convertible in cash within one year like cash, bank balances ,inventories, spare parts, accounts receivable, bills receivable. Current liabilities are those which are payable within one year like bank overdraft creditors outstanding expenses bills payable short term loans .The current assets and current liabilities runs throughout the business like electric current circuits. The working capital plays very important role as heart in a human body. The working capital is also know as circulating capital. Enormous and insufficient of working capital for the firm are very critical. Excessive of working capital are holding cash and idle funds which will not used to earn profit for the firm and that will results in unproductive use of scarce funds. This might also lead to reduces profit even though it ensures low liquidity risk. The inadequate working capital shrinks the profits and operation of business. The working capital differs from firm to firm or industry to industry. To productively manage working capital needs to focus on accounts receivable and inventories cash and short term securities (Brealey;Myres & Allen ,2006pp813)The chief company of JSW Group ,JSW Steel is unique prime steel manufacturers with capacity of 18 MTPA. Its one of the speedy company in India .Manufactures facilities located in Karnataka ,Tamil Nadu and Maharashtra that is acknowledged for its innovation and quality.It has the product include like hot rolled coils, sheets and plates and cold rolled coils and sheets.JSW steel is headquarter in Mumbai,Maharashtra ,India. JSW steel ltd is a listed public company incorporated on 15 March ,1994.Its is classified as public limited company and in Mumbai, Maharashtra. The company manufactures and sell steel products .It provides products hot and cold rolled products ,galvanized products ,galvalume products ,TMT bars ,wide rods and specially alloy steel.

REVIEW OF LITERATURE

Kien Xuan PHAM1 etal(2020)studied on the effects of working capital management on profitability of steel companies in vietnam stock exchange using independent variables like DIO,DPO,DSO,CCC,SIZ,CR,LEV,GRO the data was collected for 20 companies for 10 years 2010-2019 and found DPO, DIO, DSO, CR, SIZ, GRO factors have positive impact on profitability and CCC and LEV has negative impact on profitability.**Ramya G(2020)** study on imoact of working capital management of JSW steel company .The exploratory reseach

design the secondary data was collected over period of 10 years using percentage ,average & ratios found that current ratio was not in good position and average payment and debt ratio has improved. The JSW liquidity position is weak ,and increase investment in current asset. **Dr. Vinay Kandpal and Prof P C Kavidayal, (2013)** studied on the components of working capital on the profitability of ONDC Ltd for the period of 2000 to 2012 using correlation and regression found that raise the working capital ratios of the company reduces the profitability of ONGC for the study period. They also concluded that liquidity of the company has direct impact on profitability thus when increase in liquidity the profitability decreases and vice versa. **Richard Kofi Akoto et al(2013)** studied on working and profitability relationship listed in stock exchange for which data collected from 13 firm listed in stock exchange for 2005-2009 found there is negative relationship between the accounts receivable and profitability and profit is positively influence by the cash conversion cycle ,current asset ratio ,size and current asset turnover ratio. The author has suggested the managers to reduce the accounts receivable and cash conversion cycle to raise the profits. **Ganze VURAL et al(2012)** analysed on the working capital management on financial performance of in Turkey using correlation and regression data collected from 72 firms in stock exchange and found that Increase in profit by reducing average collection period and cash conversion cycle and if the leverage of the firm raises the profit and value of the firm will reduce. **Dong and Su (2010)** investigated the effects of working capital management and profitability of Vietnamese firms for the period of 2006-2008. the result showed there was negative relationship between profitability and cash conversion cycle component (inventory days and receivable days), positive relationship between the profit and accounts payable days. By increasing the days of accounts payable and reducing the receivable and inventories days raises the profit. **Afza and Nair (2009)** examined on the relationship between the working capital management policies and firms profitability from 204 non financial firms which were listed in Karachi Stock Exchange (KSE) with the help of regression analysis technique data for 1998-2005 and found there was negative relation between aggressiveness of working capital management investment and financial policies. the researcher suggested the managers can adopt conservative approach to create value for the firm. **M. A. Zariyawati et al(2009)** studied on the Working capital management and corporate performance: a Case of Malaysia from 1628 firm data are collected for the period 1996-2006 .the coefficient found that strong negative relationship between cash conversion cycle and firms profitability. Thus concluded if the cash conversion cycle diminishes the profits of firm increases. **Deloof (2003)** conducted a research on the Belgian market, in which to know the working capital management affects the profitability of the firm and found that accounts receivable in days ,inventories and accounts payable has negatively related with the gross operating income. The gave an idea to managers to raise the value of shareholders to reduce the accounts receivable and inventories days to the minimum. Since the accounts payable and profit has negative relationship the firm can lack in paying their bills. **Cote and Latham (1999)** examined on the impact of working capital management on profitability and found that management of inventory ,receivable and payables straightly induce the cash flow of company that would affects the its profitability.

OBJECTIVE

To examine the impact of working capital management on profitability of the company.

HYPOTHESIS

H0: Working capital management has no significant impact on profitability of company.

H1: Working capital management has significant impact on the profitability of the company.

RESEARCH METHODOLOGY

The study is based on secondary data collected from the financial statements of JSW Steel Company cover the period of 2012-2013 to 2021-2022. To analyse the data various ratios like Current Ratio(CR), Quick Ratio(QR), Inventory Turnover Ratio(ITR) and Debtor Turnover Ratio (DTR) and Operating Profit Margin have been used. To statistically infer the relationship between working capital management and profitability descriptive statistic and are used.

ANALYSIS

Descriptive Statistics

Statistics					
	CR	QR	DTR	ITR	OPM
Mean	.8501	.4600	17.6750	4.4610	.06300
Median	.8350	.4450	16.8650	3.3750	.06500
Std. Deviation	.10140	.09741	4.21532	2.44819	.060194
Minimum	.68	.35	11.40	2.45	-.080
Maximum	1.02	.61	24.87	10.44	.140

Table:1 Descriptive analysis of independent and dependent variable

From the Table 1 it is observed that the standard deviation of current ratio is 0.1. It denoted that current ratio is more or less steady as standard deviation is low. The mean of quick ratio is 0.46 and the standard deviation is 0.97. It is observed that the mean of Inventory Turnover Ratio is 4.46 and standard deviation is 3.37 during the study period which demonstrates the company is maintaining a satisfactory level of inventory. The standard deviation and Debtors Turnover Ratio is 4.21 during the study period. The mean value of Operating Profit Margin is 0.063 and the standard deviation is 0.06.

Model Summary				
Table-2				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.962 ^a	.925	.864	.02219
a. Predictors: (Constant), ITR, CR, DTR, QR				

The adjusted R- square of the above model indicates 86.4% variation in OPM of sample JSW Steel Industry that can be explained by the regression model. That is all independent (CR, QR, DTR, ITR) are contributed 86.4% for changing the dependent variable (OPM). The error term represents unexplained part of the model.

ANOVA ^a						
Table-3						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.030	4	.008	15.308	.005 ^b
	Residual	.002	5	.000		
	Total	.033	9			
a. Dependent Variable: OPM						
b. Predictors: (Constant), ITR, CR, DTR, QR						

The F – ratio in the ANOVA table test whether the overall regression model is good fit for the data the table shows that independent variables statistically significantly predict the dependent variable $p(0.005) < 0.05$ (i.e. the regression model is a good fit of the data).

Coefficients ^a						
Table-4						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.352	.068		-5.214	.003
	CR	.822	.122	1.385	6.714	.001
	QR	-.254	.113	-.411	-2.251	.074
	DTR	-.013	.002	-.897	-5.465	.003
	ITR	.013	.004	.542	3.510	.017
a. Dependent Variable: OPM						

From the above table 4 it has been found that CR has positive 1.385 and significance level is 0.001 thus the null hypothesis is rejected and alternate hypothesis is accepted. QR is negative -0.411 but the significance level is $0.074 > 0.05$. Hence the null hypothesis is accepted. In DTR the regression is -0.897, at significance level $0.003 < 0.05$ thus the alternate hypothesis is accepted. Thus raise the DTR will reduce the profitability of the company. The regression of ITR 0.542 and significance level is $0.017 < 0.05$ thus the alternate hypothesis is accepted.

CONCLUSION

The working capital management includes many activities like accounts management, inventory management and cash management. If the working capital is in shortage it leads to lack of liquidity and loss in sales therefore it is important to maintain the adequate working capital. The working capital management is important for every sector. From correlation matrix it is found that there is positive correlation over study period of JSW Steel Company. The Debtors Turnover Ratio has negative relationship with thus decrease in Debtors Turnover Ratio leads to increase in Profitability of the Company. In this study suggested the company to reduce the Debtors Turnover Ratio and Inventory Turnover Ratio, Current Ratio has the positive significance relationship thus raise in these ratios to limit for JSW Steel Company to raise the Profitability of the Company. The working capital management has the significant impact on profitability.

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SURVEY ANALYSIS USING NLP

Rohan Awale, Pranav Meshram and Pushpa Tambe

ABSTRACT

This report describes a process for analyzing the survey responses. The process begins by loading and pre-processing transcripts from a survey, which involves cleaning up the transcripts by removing stop words and splitting the transcripts into sentences. The process then involves separating the main survey question into a list of sub-questions and using a T5-base question generation model to generate sub-questions for cases where the main context of the question is missing. The process also includes a step for performing coreference resolution, using the SpanBERT model with AllenNLP to add proper context to sub-questions.

The process involves filtering out irrelevant sentences using cosine-similarity scores between sub-questions and transcript sentences, and extracting answers from the pre-processed transcripts using a deepset/roberta-base-squad2 model. The process includes a step for performing fast clustering using the T5-XLarge model and removing outliers from within clusters. Finally, the process involves labeling the clusters with topic names using the keyword extraction method and then performing outlier inclusion using the zero-shot classification model and the cluster labels. The aim of this process is to extract meaningful insights and understand what the users have answered from survey transcripts.

INTRODUCTION

The client has a customer feedback platform and their users have Questions that they want to be answered with surveys' which they conduct with them. Their panelists respond to those surveys with video responses which are 30 to 90- second selfie videos that answer a question or discuss a prompt. They are then transcribed using the speech-to-text APIs.

The problem required to be solved is that after collecting hundreds of videos, it becomes challenging for the researchers (their users) to go through all the videos and extract insights that are answers to their questions.

For a given set of video transcripts, the task is that the users should be able to ask a question which they have in mind and then get a visual representation of how the people have answered or talked about that question in their responses.

The challenge is to figure out techniques that can be tested or used to extract answers and reliably cluster those answers into buckets without knowing how many clusters could form. The part of the challenge is to also figure out the labels which should be assigned to those clusters.

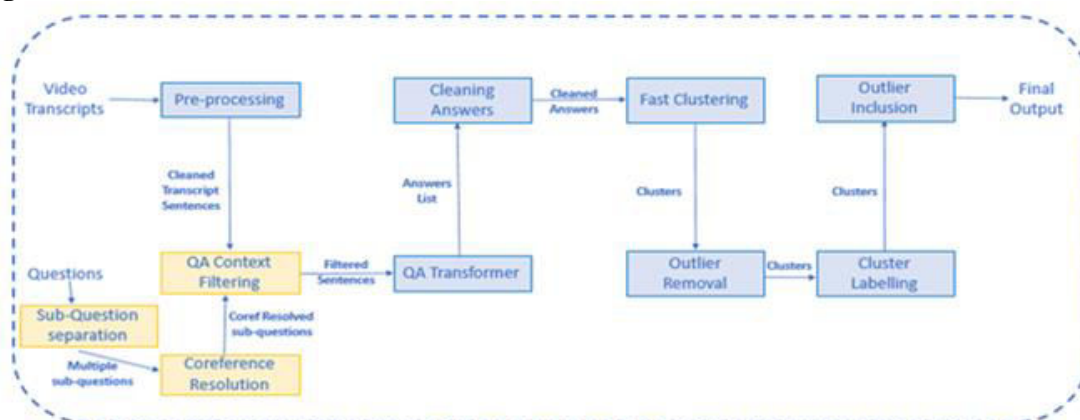
METHODOLOGY**Flow Diagram**

Fig.1 Survey Analysis SDK flow diagram

Preprocessing

The process begins with loading the CSV containing transcripts and pre-processing them, which involves the task of cleaning up transcripts by removing the stop-words which are related to speech such as 'uh' and 'um'. Then, the

transcripts are split into sentences based on the punctuation '.' for the question- answering task.

Sub-Question separation

Sub-question separation involves the task of splitting the main survey-question into a list of multiple sub-questions based on the number of questions present in it by splitting using the ‘?’ symbol.

The other task involved is to generate the sub-question again using the help of T5- base question-generation model for the case of the sub-questions which have small character length considering that the main context of the question is missing.

Coreference Resolution

Coreference resolution refers to the task of finding all expressions that refer to the same entity in a text. It is important for the sub-question to contain the context which is present in the main survey question. So to correct coreference in sub-questions such as "it" and "them", the SpanBERT model using AllenNLP is used to add proper context for the question-answering task as sub-question without context would result in an incorrect answer or a low-confidence answer.

Context Filtering

For context-filtering embeddings are created using sentence-t5-xl model for the sub-question and cleaned transcript sentences and then the cosine-similarity scores between all sub-question and transcript sentences pairs is calculated. Irrelevant sentences based on low cosine-similarity score with the sub-question are filtered out as they probably don't contain the answer in context to the sub-question.

Question-Answer Transformer

All answers from the pre-processed transcripts are extracted for each transcript with respect to each sub-question using the deepset/roberta-base-squad2 model with the help of HuggingFace pipelines. A question-answering threshold is applied on the answer scores to filter out the low-confidence answers. The threshold used here is 0.05.

After getting all the unique answers, preprocessing is applied where all answers are converted to lower cases, special characters are removed, and stop words are removed without removing words that imply negation since it is important for context here.

Fast-Clustering

Fast Clustering is an algorithm tuned for large datasets to be clustered very fast using a community detection algorithm where a local community of a set of highly similar sentences is detected. It takes in two main parameters – first, cosine- similarity threshold which defines a criterion to consider two sentences as similar and second, minimum community size which basically returns clusters larger or equal to the minimum community size.

Fast Clustering is highly dependent on good sentence embeddings and therefore we tried various top models using Sentence-transformers with high semantic- similarity scores such as T5-XL, Mpnet, and Roberta models. Among them all, T5- XLarge model gave the best output with minimum community size 3, and cosine- similarity threshold 0.8.

Outlier Removal

To remove the outliers from within the cluster, cosine-similarity can be used where the cosine-similarity score for each element with another element within a cluster is calculated and then the mean of that is considered as the cosine-similarity score of that answer within the cluster. The overall mean of all scores is also calculated and a certain deviation threshold is subtracted from it and all answers with scores below this value (Overall Mean – Deviation Threshold) are removed from the cluster as outliers. The deviation threshold used here was 0.05.

Cluster Labelling

After removing Outliers from within Clusters and assuming that the clusters are correct a topic name is required for what the clusters represent and for that, various keyword extraction methods can be carried out. We tried Gensim based keyword Summarization, Yake, Rake, KeyBERT, and PKE Multipartite Rank methods.

For all the methods, same clusters after fast clustering & cosine-similarity based outlier removal are used. Top three keywords or key phrases are extracted from them and out of all methods PKE gives the best result. Still, the top key phrase was not always the correct phrase and therefore best key phrase from top three phrases is selected by checking the cosine-similarity score of each phrase with the cluster and the one with the highest score is considered as a Label.

OUTLIER INCLUSION

Zero-shot classification model allows to classify text data into labels, which wasn't used to build the model. It is required to define labels to classify the data. It is used to classify all the outlier answers which are not part of fast clustering output and outliers that were removed from within. For this, the labels generated using the PKE Multipartite Rank method are used and the best key phrase is selected from the top three PKE outputs and the most frequent word of the cluster. Here, the zero-shot score threshold is used to classify the outliers into the appropriate cluster and instead of using cleaned answers, their corresponding answer sentences are used for more context which comparatively improved the results. The threshold used here was 0.5.

RESULTS

Consider the survey question in fig.2 where there are 2 questions in the main survey-question which are then split into 2 sub-questions during sub-question separation stage.

For the 2nd sub-question, there is a coreference to "plant-based meats" using "it" which is then resolved during the coreference resolution stage.

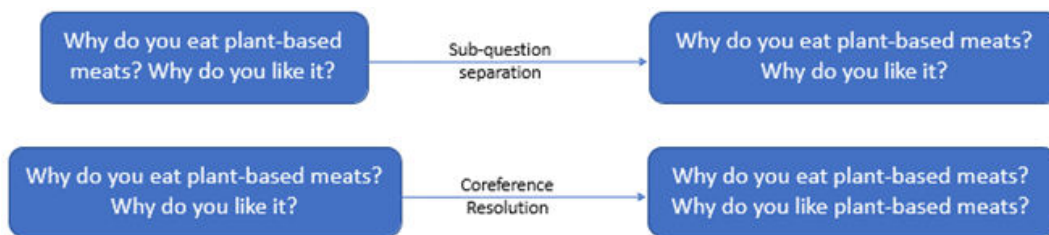


Fig.2 Sub-Question Separation & Coreference Resolution output

After context-filtering stage the transcript and sub-question pairs which are obtained are pass through the question-answering stage where the respective answers are extracted as shown in fig.3.

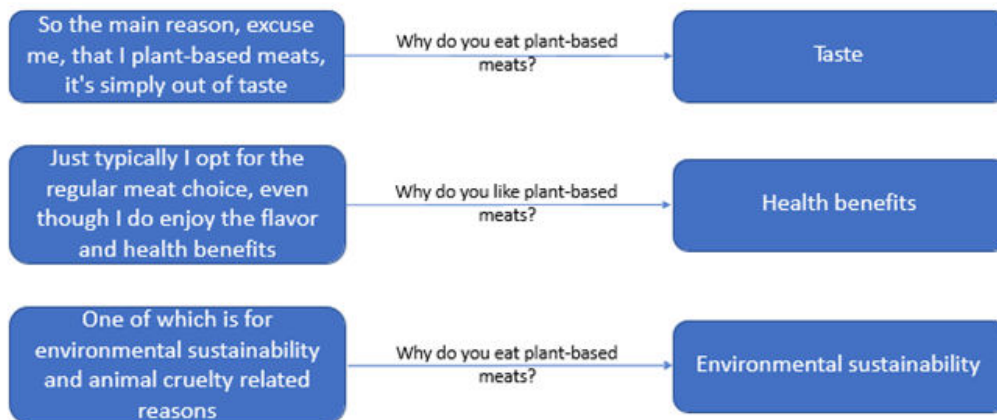


Fig.3 Question-Answering output

After all, answers are extracted and cleaned, fast-clustering is applied where the answers are grouped into clusters as shown in fig.4 and the answers which were not assigned to any cluster are treated as Outliers.

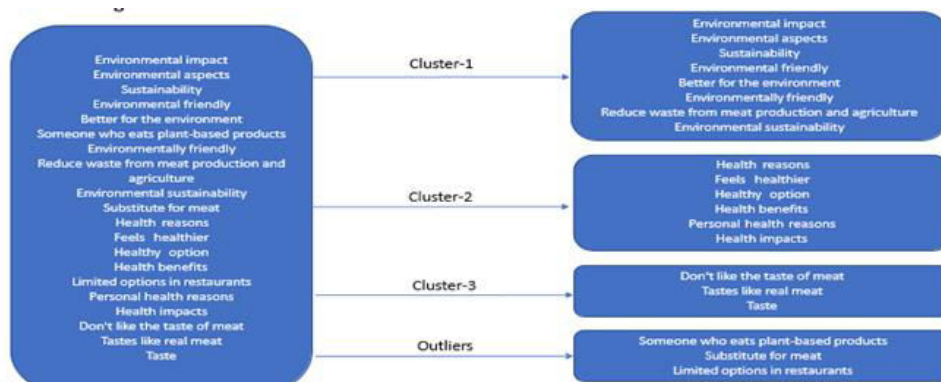


Fig.4 Fast-Clustering Output

Finally, the cluster-labeling stage assigns the appropriate labels to the cluster using PKE.

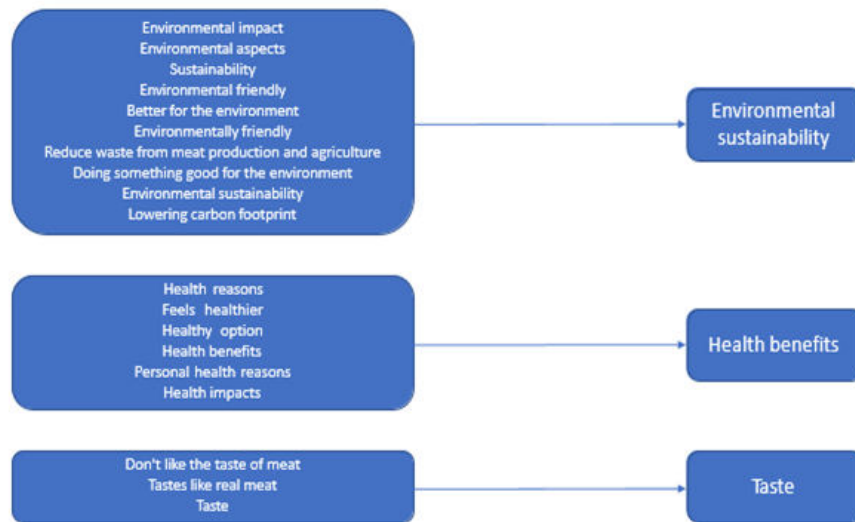


Fig.5 Cluster Labelling

CONCLUSION

The Survey Analysis SDK successfully generates the output for a given survey within 2-5 minutes based on the number of transcripts and sub-questions. For a human, the time taken for clustering the answers would increase vastly with an increase in the number of answers. It allows to speed-up the process of analysis by giving output in real-time which allows the researchers more time to validate the results and garner additional insights. Overall, this process can be useful for companies seeking to understand the needs and preferences of their customers, and to identify areas for improvement in their products or services.

Task	Quantity	Approx. Manual Efforts (in seconds)	Survey Analysis SDK time taken (in seconds)	Speed Up factor
Question-Answering	30 Transcripts & 3 Sub-questions	1800	90	20
Clustering	100 Answers	1200	20	60
Labelling	10 Clusters	600	20	30

Table 1 Time Savings

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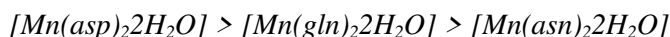
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ECO-FRIENDLY SYNTHESIS, STABILITY AND BIOLOGICAL EVALUATION OF MN(II)- α -AMINO ACID COMPLEXES**K. P. Srivastava* and Anuradha Singh**

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ABSTRACT

An easy, efficient, clean, and eco-friendly method was used to synthesize Mn(II)-complexes with α -amino acids: L-Asparagine (L-HAsn), L-Glutamine (L-HGln) and Aspartic acid (L-H₂Asp). Elemental analysis, conductivity measurements, magnetic moment, and spectral analysis like physico-chemical methods were used to characterize the synthesized complexes. The elemental analysis data of the investigated complexes revealed their 1:2 (metal to ligand) stoichiometries and monomeric nature and very low molar conductance values show their non-electrolytic nature. The infrared spectral studies revealed the monobasic bidentate (N & O donor) nature of the amino acid ligands which coordinated through amino-N and carboxylate-O with Mn²⁺ ion in the complexes. The magnetic moment values and electronic spectral studied indicated the octahedral geometry of the investigated complexes. The overall stability constants, which are the products of the stepwise stability constants of the octahedral (K₁×K₂) metal-amino complexes, are very high, revealing good stability and the stability order of the complexes is as follows:



The investigated amino acids were found to exhibit low to moderate activity but all the complexes exhibited varied vigorous activity against different bacteria. The amino acids which were less active before complexation became more active upon coordination with Mn²⁺ ion.

Keywords: Amino acids, Transition metal complexes, Octahedral complexes, Stability constants, Antibacterial activity

INTRODUCTION

The fundamental bioinorganic coordination chemistry of the transition metal ions with biological molecule ligands was an underdeveloped field and now rapidly developing and centred on the presence of coordination compounds in living systems. Within biological organisms, essential trace metals are required for optimal functioning of biochemical processes, while toxic, trace metals disrupt these processes leading to physiological abnormalities or even organism death. Amino acids combine many of the properties and reactions of both amines and carboxylic acids. The combination of a basic amino group and an acidic carboxyl group in the same molecule also results in some unique properties and reactions. Metal ions are usually coordinated by nitrogen, oxygen or sulfur centers belonging to amino acids [1-2]. These centers may be provided by main-chain amino and carbonyl groups. However generally metal binding is achieved by the amino acid side chains. Especially, carboxylate groups of aspartic and glutamic acid; hydroxyl groups of serine, threonine, tyrosine; the ring nitrogen atom of histidine and tryptophan enable to bind metals as donor groups [3-4]. Complexation of a metal ion usually increases the stability of the metallic species; thus, the complex of a metal ion is more stable than the metal ion itself [5-6]. The extensive kinetic study on reactions of metal complexes and the applications of several spectroscopic methods to establish their structures have further fine-tuned the understanding of these classes of compounds [7-8].

Due to their applications in various fields like metal complexes as drugs and chemotherapeutic agents [9-10], catalysts [11], non-linear optical materials [12], for the conversion and storage of solar energy [13], for hydrometallurgy and extraction [14], for biomedical applications [15], for photodynamic therapy [16], as precursors for semiconductor films and nano-particles [17], motivate us for efficient synthesis, stability constants and biological evaluation of Mn²⁺ complexes with some common α -amino acids as ligands. As a part of our continuing efforts to synthesize and characterize transition metal complexes using amino acids as ligands [18-19], the present research article describes the structure elucidation, antimicrobial activity, and stability constants of Mn(II) complexes of α -amino acids: L-Asparagine (L-HAsn), L-Glutamine (L-HGln) and Aspartic acid (L-H₂Asp) (Table-1) synthesized through environmentally benign methods. Although, single crystal of the investigated complexes could not be isolated from any solutions; however, analytical data, magnetic moment data and spectroscopic studies enable us to propose possible geometries of the investigated complexes.

The main aim of this study is to contribute to efforts being made to search for novel chemotherapeutic agents in the treatment of certain diseases.

Table-1 Amino acids used as ligands

Name of amino acids	L-Asparagine	L-Glutamine	L-Aspartic Acid
Symbol	N	Q	D
Abbreviation	HAsn	HGln	H ₂ Asp
Isoelectric Point	5.4	5.7	2.8

EXPERIMENTAL

Materials & Method

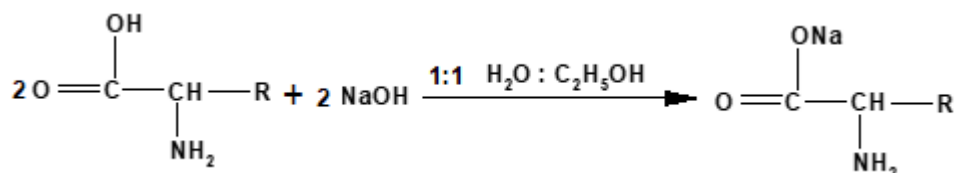
All the used chemicals and solvents were of Anal R grade. The amino acids L-Asparagine (HAsn or N), L-Glutamine (HGln or Q) and L-aspartic acid or aspartate (H₂Asp or D) were purchased from Loba Chemie which were used as received without further purification. The metal salt and amino acid solutions were prepared by direct dissolution in doubly distilled water. Metal salt was obtained from S.D. Fine chemical, Mumbai. Solvents were purified and dried according to standard procedure [20].

All the investigated compounds were analysed satisfactorily for C, H, X and N using Carl-Ebra 1106 elemental analyser in micro analytical laboratory. Metal and chloride contents of the transition metal complexes were analysed following standard methods [21]. The melting/decomposition points were determined by placing a finely powdered sample in a glass capillary and heating by using a Mel-Temp melting point apparatus and were uncorrected. Molar conductance measurements were taken using 10⁻³M solution of the complexes in DMSO on Elico-CM 82 Conductivity Bridge at room temperature provided with a dip type conductivity cell fitted with platinum electrodes. Magnetic susceptibility measurements of investigated solid complexes were carried out on a Gouy's balance at room temperature using mercuric tetrathiocyanatocobaltate (II) as the calibrant. Diamagnetic corrections were applied in compliance with Pascal's constant [22].

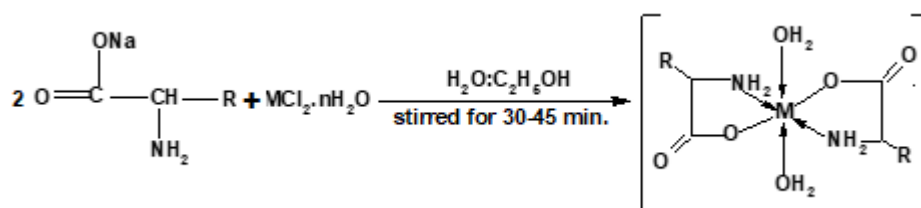
The solution spectra were measured or recorded at room temperature on Systronic UV-VIS spectrophotometer Type 119 PC based ($\lambda = 200-1000$ nm & band width 2nm) using DMSO as the solvent. The FT-IR spectra were recorded in KBr medium and Nujol mull techniques on a Perkin Elmer RX1 spectrophotometer in wave number region 4000-400 cm⁻¹. The proton nuclear magnetic resonance spectra of complexes were taken in CDCl₃ or D₂O (wherever solubility permitted this) using Hitachi R-600 FT NMR spectrophotometer. Tetramethyl silane (TMS) was employed as the internal reference.

Synthesis of Mn (II) complexes:

A solution of MnCl₂·4H₂O (1 m mole) in 1:1 mixture of ethanol and water (10 mL) was added to a solution of the ligand (4 mmol) in 20 ml H₂O/ethanol (50%) mixture containing 0.33 mL 30% NaOH (for deprotonation of the amino acids, scheme-1) using stoichiometric amount (1:2) [(metal: 2(Na⁺ L)] molar ratio [23]. The reaction mixture was stirred for several minutes (30-45 minutes) at room temperature. After 1.5 hours a coloured crystalline solid was obtained which was filtered and washed with water-ethanol then triethyl ether. The solids were recrystallized from (H₂O: DMSO) (30:70) volumes' mixture and dried in vacuum over anhydrous CaCl₂ (Scheme-2) at 60°C. The yields range from 80 to 90 %. The compounds were found to be soluble in DMSO and hot water (scheme-2).



Scheme-1: Deprotonation of used amino acid ligands



Scheme-2: Synthesis of Ni-complexes of amino acids

Where R = CH₂CONH₂ for N (HAsn), R = CH₂CH₂CONH₂ for Q (HGln),

R = CH₂COOH for D (H₂Asp) and M = Mn(II)

Determination of Stability Constants of the Complexes

A mixture of 100 mL of 0.04M, KNO_3 , 10 mL of 0.02M HNO_3 , 90 mL of distilled water and 1 mmol. (0.001mol.) of Mn(II) chloride tetrahydrate were added into a 400 mL beaker respectively. 0.05 mL of 0.1M Sodium asparaginate was added and after each addition with stirring the corresponding pH reading was recorded. The addition of the sodium asparaginate solution was continued until the full 10 mL was added. The sodium asparaginate was prepared by exactly neutralizing a weighed solid asparagine with a calculated amount of standardized 0.1M NaOH and diluting the solution with distilled water to a total volume of 20 mL out of which 10 mL was put into a cleaned and rinsed burette. The same procedure was repeated for each of the remaining amino acids [24].

Antimicrobial Activity of Complexes

The antimicrobial activities of complexes were studied in vitro using agar cup method [25]. The strains used were Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Proteus vulgaris, and Bacillus subtilis clinical isolate for bacteria. In the agar cup method, a plate of sterile nutrient agar with the desired test strain was poured to a height of about 5 mm, allowed to solidify and a single cup of about 8 mm diameter was cut from the centre of the plate with a sterile cork borer. Thereafter, the cup was filled with the sample solution of known concentration and the plate was incubated at 37°C for 24 h. The extent of inhibition of growth from the edge of the cup was considered as a measure of the activity of the given compound. By using several plates simultaneously, the activities of several samples were quantitatively studied. All the tests were performed in triplicate.

RESULTS & DISCUSSION

The modern spectral techniques such as IR, UV-Vis, and ^1H NMR are used for characterization of the Mn(II) complexes of some common α -amino acids. Elemental analysis data and physical characteristics of ligands and complexes are presented in table-2 & 3.

Physical Properties

All these complexes are intensively coloured, non-hygroscopic and thermally stable amorphous solids. They are insoluble in common organic solvents and only soluble in DMF and DMSO. Molar conductance values of the soluble complexes in DMF (10^{-3}M solution at 25°C) indicate the non-electrolytic nature of the complexes [26]. The elemental analyses data concur well with the planned formulae for the ligand and recognized the $[\text{ML}_2 \cdot 2\text{H}_2\text{O}]$ composition of the Mn(II) complexes.

Table-2: Empirical formula, molecular weight, colour, decomposition temperature and pH of the investigated Mn(II) complexes

Complex	Empirical Molecular	formula weight	Colour	Decomposition temperature ($^\circ\text{C}$)	p ^H	% Yield
[Mn(asn) ₂ 2H ₂ O]	[Mn(C ₄ H ₇ N ₂ O ₃) ₂]	316.94	Pinkish yellow	205	7	72
[Mn(gln) ₂ 2H ₂ O]	[Mn(C ₅ H ₉ N ₂ O ₃) ₂]	342.94	white greenish	212	7	65
[Mn(asp) ₂ 2H ₂ O]	[Mn(C ₄ H ₆ NO ₄) ₂]	318.94	Yellow	217	6	79

Table-3: Elemental analysis data, molar conductance, and magnetic moments of investigated Mn(II) complexes

Complex	Elemental analysis Found (Calcd.)				Molar conductance ($\text{Ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$)	μ_{eff} (in BM)
	%M	%C	%H	%N		
[Mn(asn) ₂ 2H ₂ O]	17.33 (17.40)	30.29 (30.10)	4.42 (4.36)	17.67 (17.65)	0.20	5.88
[Mn(gln) ₂ 2H ₂ O]	16.02 (16.10)	34.99 (35.05)	5.25 (5.30)	16.33 (16.40)	0.28	5.91
[Mn(asp) ₂ 2H ₂ O]	17.23 (17.30)	30.09 (30.00)	3.76 (3.75)	8.78 (8.80)	0.35	5.89

Infrared Spectral Studies

The IR spectra of the metal complexes were recorded in KBr discs over the range $4000\text{--}400 \text{cm}^{-1}$. These spectra were complex due to the presence of numerous bands with varying intensities, making the interpretation task quite difficult. However, an attempt has been made to assign some of the important bands based on reported infrared spectra of several N- and O-donor ligands, and their metal complexes (Table-4).

The infrared spectrum of the free ligand exhibited a broad band at 3336-3420 cm^{-1} which was assigned to the NH_2 stretching frequency. Intense bands at 1385-1560 and 1410-1620 cm^{-1} were observed and are attributed to $\text{COO}^-_{\text{asy}}$ and COO^-_{sy} stretching frequencies, respectively [27].

For the investigated complexes the COO^- asymmetric stretching frequencies were shifted to lower frequencies compared with that of the ligand. Bands in the region of 350–410 cm^{-1} indicate the formation of M–O bond and further support the coordination of the ligand to the central metal ion via the oxygen atom of the carboxylate group [28]. Hypsochromic shifts were observed for the $-\text{NH}_2$ frequencies on coordination, for the investigated complexes. This indicates bond elongation on coordination. It therefore suggests probable octahedral geometry for the complexes. New bands in the spectra of the complexes at 470–515 cm^{-1} were assigned to (M–N) stretching frequency. The participation of the lone pairs of electrons on the N of the amino group in the ligand in coordination is supported by these band frequencies [29]. Similarly, broad sharp bands at 3560–3620 cm^{-1} in the investigated complexes, obviously shows the presence of co-ordinated water in the complexes. The new sharp bands appeared at 350–410 cm^{-1} and 470–515 cm^{-1} in the spectra of investigated complexes clearly suggest the formation of (M–O) and (M–N) bonds on complexation [30–31].

Table-4: Important Infrared Spectral bands of ligands and Mn(II) complexes

Compound	$\nu(\text{O-H})$	$\nu_s(\text{NH}_2)$	$\nu_s(\text{COO}^-)$	$\nu_{\text{asy}}(\text{COO}^-)$	$\nu(\text{M-N})$	$\nu(\text{M-O})$
HAsn	--	3410m	1648m	1585s	--	--
HGln	--	3390s	1645s	1594s	--	--
H ₂ Asp	--	3380w	1650s	1583s	--	--
[Mn(Asn) ₂ 2H ₂ O]	3560s	3336bs	1585s	1480w	515	390
[Mn(Gln) ₂ 2H ₂ O]	3590s	3350m	1410s	1385m	520	410
[Mn(Asp) ₂ 2H ₂ O]	3620s	3420m	1620s	1560s	470	350

w: weak; m: medium; s: strong; br: broad

¹H- NMR Spectral Studies

In all the ligands, signal of $-\text{COOH}$ appeared at 10.95 ppm (δ -scale) but in metal complexes these signals do not appear, probably due to replacement of H^+ by metal ion. The signal due to protons of NH_2 appeared perturbed (decreased) probably due to coordination by N of NH_2 to metal ion [32]. The NMR spectral study clearly shows the formation of complexes by the ligands. The NMR spectral results are presented in table-5.

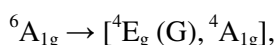
Table-5: Relevant ¹H-NMR signals for the compounds

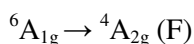
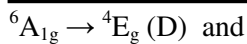
Type of protons (In Ligands)	Nature of signal	Chemical shifts	
		δ	τ
$-\text{COOH}$	singlet	10.95	-0.95
$-\text{CONH}_2$	Broad singlet	8	2
$-\text{NH}_2$	Broad singlet	6	4
$=\text{CH}$	quartet	4.2	5.8
$-\text{CH}_2$	pentate	2.1	7.9
(In Complexes)			
$-\text{COOH}$	--	--	--
$-\text{CONH}_2$	Broad singlet	8	2
$-\text{NH}_2$	Broad	6.2	3.8
$=\text{CH}$	quartet	4.2	5.8
$-\text{CH}_2$	pentate	2.1	7.9

Electronic Spectral Studies

The electronic spectra of the ligands showed three absorption bands at 187-196, 210-216, and 223-232 nm assigned as the $n \rightarrow \sigma^*$, $n \rightarrow \pi^*$, and $\pi \rightarrow \pi^*$ transitions of the major chromophores, NH_2 and COO^- , present in the ligand molecules. On coordination, however, shifts were observed in these bands in addition to d-d transitions bands (Table-6). These in conjunction with the magnetic moment of the complexes were used to propose probable geometry of the complexes obtained.

The electronic spectra of the investigated complexes in DMSO were recorded in the UV-visible region. The spectra for the investigated Mn(II) complexes displayed three bands at 466-489, 452-466 and 432-456 nm, assigned to





d-d transitions respectively. This was the indicative that the investigated complexes were the mononuclear complexes with 6-coordinated high-spin octahedral geometry [33]. These transitions are a consequence of forbidden transitions to excited states of spin multiplicity other than six. This proposed geometry was corroborated by their magnetic moment value of 5.88 -5.91 BM [34]. The important electronic spectral bands along with their assignments of the isolated ligands and the complexes under investigation are listed in table-6.

Table-6: Electronic spectral bands and proposed geometry of the Mn(II) complexes

Compound	nm (ϵ , $\text{cm}^2 \text{ mol}^{-1}$)		μ_{eff} (in BM)	Proposed geometry of complexes
	Ligand bands	d-d bands		
HAsn	187, 200, 210	--	--	--
HGln	192, 200, 215	--	--	--
H ₂ Asp	196, 212, 232	--	--	--
[Mn(asn) ₂ 2H ₂ O]	--	466, 452, 432	5.88	O _h
[Mn(gln) ₂ 2H ₂ O]	--	470, 454, 445	5.91	O _h
[Mn(asp) ₂ 2H ₂ O]	--	489, 466, 456	5.89	O _h

Proposed Geometry of Ni-Complexes

Based on the above observations, it is tentatively proposed that investigated Mn(II)- α -amino acid complexes show an octahedral geometry [Figure-2] in which the ligands act as mono-negative bidentate [N & O donor] ligands.

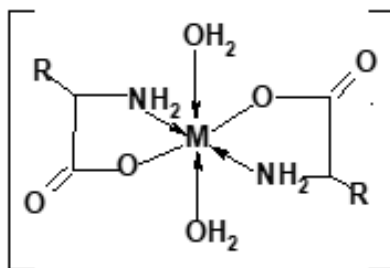


Figure-2: Proposed octahedral geometry (O_h) of the investigated Mn-complexes

Stability Constants of Complexes

All the investigated ligands contain two donor groups (the amino and carboxylate groups), and therefore two hydrogen ions can dissociate from the fully protonated cations of the amino acids (H²L⁺). Dissociation of these protons occurs stepwise, but in well-separated processes, and the aliphatic amino acids can appear in three different forms in different pH ranges: the cationic (H²L⁺), the neutral or zwitter ionic (HL) and the anionic (L⁻) forms.

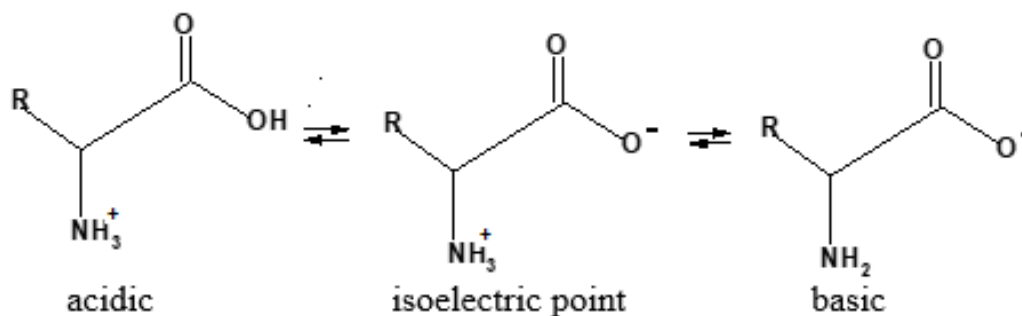


Figure-3: Amino acid dissociation at equilibrium

Amino acids are good metal-complexing agents, forming chelate rings through the amino and carboxylate groups via dissociation of acidic proton as a bidentate N, O-donor (figure-4). These complexes contain 5-membered chelate rings formed via the coordination of amino-N and carboxylate-O donors.

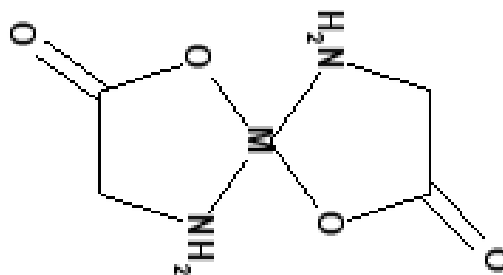


Figure-4: General structural formula proposed for metal-amino acid complexes

The stepwise stability constants ($\log K_1$ and $\log K_2$) of all the octahedral complexes are quite high, suggesting stable reaction intermediate species. The overall stability constants, which are the products of the stepwise stability constants of the octahedral ($K_1 \times K_2$) metal-amino complexes, are very high, revealing good stability (Table-7). This observation was made by L. Antolini [35], the values were found to decrease in the order $K_1 > K_2$, which is expected based on electrostatic concept. The overall stability constant of each complex was determined as the product of the stepwise stability constant; $\beta = K_1 \times K_2$. The number of coordinated amino acid anions to a metal ion determined for nickel is 1:2, which have octahedral geometry. These values agree with the results obtained from similar work carried out by several workers [36-39]. The values of stability constants of investigated Mn(II)-complexes revealed their stability in the following order:

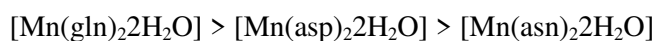


Table-7: Stability constants of investigated Mn(II)-complexes

Amino acid	Complexes	$\log K_1$	$\log K_2$	$\log \beta$
Asparagine (Hasn)	$[\text{Mn}(\text{Asn})_2 2\text{H}_2\text{O}]$	8.59	8.55	17.06
Glutamine (Hgln)	$[\text{Mn}(\text{Gln})_2 2\text{H}_2\text{O}]$	9.89	9.75	19.64
Aspartic Acid (H ₂ asp)	$[\text{Mn}(\text{Asp})_2 2\text{H}_2\text{O}]$	9.78	9.72	19.50

Antimicrobial Activities

The metal (II) complexes were evaluated for antimicrobial activity against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus vulgaris*, and *Bacillus subtilis* by agar cup method. The test solutions were prepared in DMSO, nutrient agar used as culture medium. The zone of inhibition was measured in mm and the values of the investigated compounds are summarized in table-8. From the observed result the metal(II) complexes showed enhanced antimicrobial activity. Probably this may be due to the greater lipophilic nature of the complexes. Such an enhanced activity of the metal (II) complexes can be explained based on Overton's concept and Chelation theory [41-42]. A possible explanation for the observed increased activity upon chelation is that the positive charge of the metal in chelated complex is partially shared with the ligand donor atoms so that there is an electron delocalization over the whole chelate ring. This, in turn, will increase the lipophilic character of the metal chelate and favours its permeation through the lipid layers of the bacterial membranes. Therefore, the present results revealed the importance of amino acids complexes and can be associated with antibiotics, to control resistant bacteria, which are becoming a threat to human health and suggest their potential application as potential antibacterial agents, in the field of disinfection, food packaging and piping of drinking water.

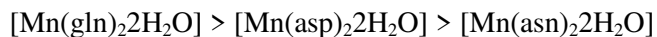
Table-8: Antibacterial activity of investigated compounds

Compounds	Zone of Inhibition (in mm)				
	<i>E. coli</i>	<i>P. aeruginosa</i>	<i>P. vulgaris</i>	<i>S. aureus</i>	<i>B. subtilis</i>
HAsn	8.09	6.04	6.07	7.10	7.05
HGln	8.03	7.02	6.07	6.09	7.01
H ₂ Asp	6.02	6.07	6.00	6.01	6.01
$[\text{Mn}(\text{Asn})_2 2\text{H}_2\text{O}]$	7.86	5.78	6.20	6.54	7.01
$[\text{Mn}(\text{Gln})_2 2\text{H}_2\text{O}]$	7.48	6.98	6.65	6.54	6.85
$[\text{Mn}(\text{Asp})_2 2\text{H}_2\text{O}]$	6.21	6.75	6.32	6.15	6.00
Umequine	10.05	6.02	8.25	9.52	10.15

CONCLUSIONS

Three Mn(II)-complexes of three α -amino acids: L-Asparagine (L-Hasn), L-Glutamine (L-Hgln) and Aspartic acid (L-H₂asp) respectively were synthesized by easy, efficient, clean, and environmentally benign method. The synthesized complexes were characterized by elemental analysis, conductivity measurements, magnetic

moment, and spectral analyses. The elemental data of the investigated complexes revealed their 1:2 (metal to ligand) stoichiometries and monomeric nature and lower molar conductance values show the non-electrolytic nature of the complexes. The infrared spectral studies revealed the monobasic bidentate (N & O donor) nature of the amino acid ligands which coordinated through amino-N and carboxylate-O with Mn^{2+} ion in the complexes. The magnetic moment values and electronic spectral studied indicated the octahedral geometry of the investigated complexes. These complexes contain 5-membered chelate rings formed via the coordination of amino-N and carboxylate-O donors. The overall stability constants, which are the products of the stepwise stability constants of the octahedral ($K_1 \times K_2$) metal-amino complexes, are very high, revealing good stability and the stability order of the complexes is as follows:



The synthesized complexes were found to be more active compared with their respective free ligands against the same bacteria and under the identical experimental conditions.

ACKNOWLEDGEMENTS

Co-author Dr. Anuradha Singh is thankful to her mother Dr. Indu Singh, Ex- Professor-in-charge, Ganga Singh College, J. P. University, Chapra, Bihar for his kind cooperation and suggestion during the completion of his research project.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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ASSESSMENT OF THE SUSTAINABILITY OF SUGARCANE PRODUCTION. GLOBAL TREND

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ABSTRACT

The present study of the distribution of standards with sustainability in the production of sugar cane, the countries and institutions with contributions; and the most common keywords, and future trends. Bibliometrics was used, and 17 articles were selected from the Scopus data analysis base, between 2000 - 2021. For co-authorship and coincidence analysis, bibliometric maps were used, through the VOSviewer software (version 1.6.18, University of Leiden, Netherlands). The results are certain that the first publication of sugar cane was in 2001, and the trend has been increasing over time. Brazil was the country with the highest number of publications (8431 articles), followed by the USA (4174) and India (4137). The three institutions with the highest number of publications are from Brazil, and the author with the highest number of publications is of Thai origin. Research on sugarcane production and its sustainability is a multidisciplinary subject, and Brazil is the country with the greatest interest in research related to this topic.

Keywords: bibliometric analysis, countries co-authorship, keyword co-occurrences, sustainability, sugarcane, VOSviewer, Scopus database.

1. INTRODUCTION

Sugarcane is one of the main crops worldwide and its production has an important impact on economic, social and environmental issues.

In Mozambique, the sugar industry, due to the expansion of sugar production with foreign investment and the involvement of small agricultural producers in the production of the raw material, is considered one of the most promising industries in the country. The history of the industry is characterized by continuous, discontinuous processes, resulting from the economic policy options adopted, with effects on the integration mechanisms of small agricultural producers (Joaquim et al., 2021).

The Mozambican sugar industries are located in the floodplains of the Incomati (Xinavane and Maragra), Pungue, Muda (Mafamabisse) and Zambeze (Marromeu) rivers and the fields generally drain into the river, and in these places the sugar cane is grown under irrigation, in plantations that surround the respective factories.

This industrial sector employs more than 30,000 permanent and seasonal workers, mainly from rural areas, where employment alternatives are scarce (Jafar, 2020).

As a way to reach competitive levels of production and productivity in the international market, the use of inputs such as inorganic fertilizers, herbicides and pesticides is more intensive in these plantations. As a reflection of this intensity, the potential productivity levels of these crops have been below the desired level, forcing companies to look for alternatives through the expansion of their areas, through contracts with small producers of vegetables, corn and rice, in potentially more productive areas.

Excess fertilizers can negatively impact groundwater quality and reduce profit margins, while a lack of fertilizers can restrict productivity and crop quality (Mohamed et al., 1996).

The environmental impacts of chemical inputs on soil and water sources are estimated to be small in absolute terms. However, in the future, the extent of such impacts may grow along with the growth of the commercial sector, leading to a decline in income at an unsustainable rate for the industry.

The search for new areas by the sugar industries is accompanied by reduced access to arable land as a means of subsistence for rural communities, the incidence of health problems related to the organization of recruitment and work in the sugarcane fields and the relationship between the production of sugar and environmental problems, related to the quality of land, air and water (O'Laughlin & Ibraimo, 2013).

Therefore, the production of sugar cane makes a positive contribution to the acquisition of income for the country's economic growth, but, however, its general impact remains unclear in terms of its sustainability (economic, social and environmental), thus influencing the important aspects that are necessary for sustainable rural development.

In this context, the present study aims to i) analyze distribution patterns of articles related to the study of sustainability in sugarcane production; ii) show the countries and institutions with the greatest contributions; (iii) highlight the most common keywords in searches; (iv) provide relevant information on this topic and future trends. This research is a contribution for researchers, policy makers and individuals to understand the research trend on sustainability in sugarcane production and its indicators. Through this, it is possible to identify the existing potential and opportunities for future research, thus helping the players in this sector to make better decisions without hurting the different players in the process, namely the sugar agroindustries, the communities and the environment.

2. METHODOLOGY

This research followed the bibliometric analysis method, which is the quantitative study of bibliographic material. This analysis provides an overview of a research field that can be classified by articles, authors and journals (Merigó & Yang, 2017). Citation analysis, co-citation, and bibliographic link citation, as well as co-word analysis, are the various approaches included in bibliometrics.

2.1. Data source and collection

Through the Scopus database, publications were searched containing “assessment* sustainability* sugarcane* indicators* in the title, abstract or keywords, between the years 2000 to 2021. The search string followed was (TITLE-ABS-KEY (assessment AND sustainability AND sugarcane AND production) OR TITLE-ABS-KEY (sugarcane AND sustainability AND indicators)) AND (EXCLUDE (PUBYEAR , 2022)) AND (LIMIT-TO (DOCTYPE , "ar")). This query resulted in a total of 251 documents. In order to guarantee greater reliability and scientificity of the research results, it was limited to working only with scientific articles, which after filtering resulted in 187 illegible articles.

Search results were analyzed based on year, source, subject area, country and author. Bibliometric indicators such as total publications, total citations, CiteScore and h-index were used to classify the most productive authors in the research area.

2.2. Bibliometric maps

Citation, bibliography and author keywords of the 187 identified articles were exported to VOSviewer (version 1.6.18, University of Leiden, The Netherlands), which is software used to create, visualize and explore maps based on network data.

2.2.1. Co-authorship analysis

In the co-authorship analysis, all 12 associated countries were included, divided into 5 clusters, namely Brazil, Colombia, Mexico (cluster 1); Iran, South Africa and England (Cluster 2); India, Netherlands and Sweden (Cluster 3); Thailand and United States of America (Cluster 4) and Australia (Cluster 5).

2.2.2. Co-occurrence analysis

In VOSviewer, the minimum parsing of keyword occurrences is 5 (Van Eck & Waltman, 2010). In this part of the research phase, the number of occurrences of keywords that were viewed with greater frequency was verified.

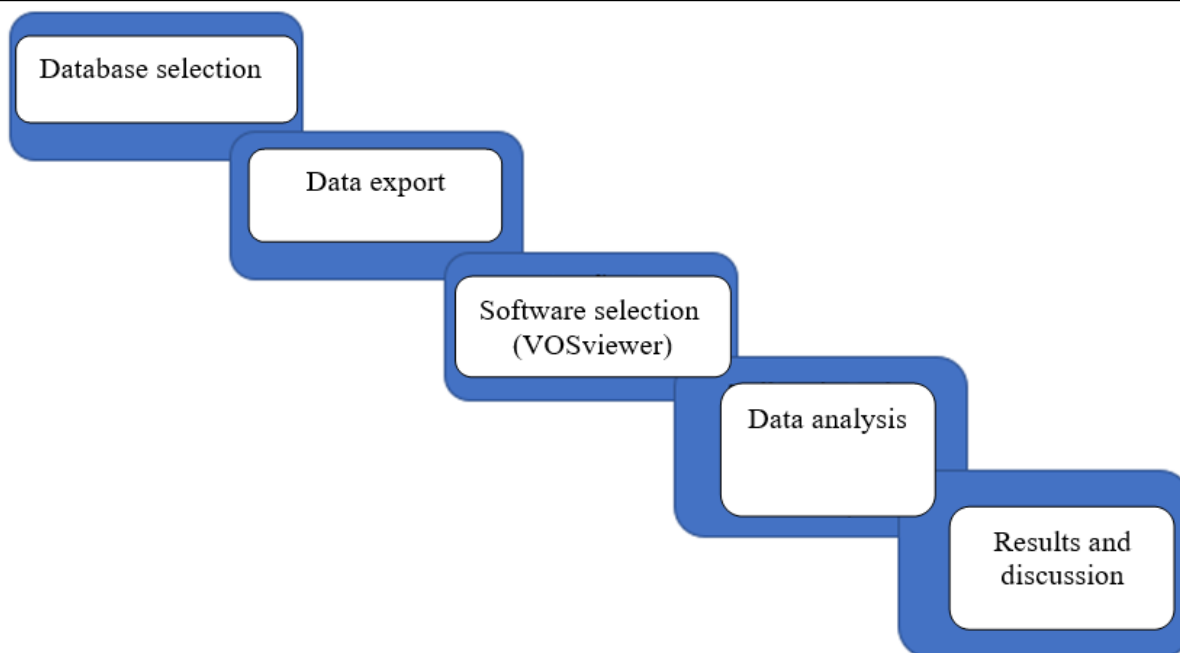


Figure 1. Stages of the research methodology

3. RESULTS AND DISCUSSION

3.1. Published articles and interest in research

In the period under analysis (2000 to 2021), which corresponds to 21 years, 187 articles were published. The oldest publication was in the year 2000 (Lisson et al., 2000). Based on the data, the strong interest in research on sustainability in sugarcane production began in 2015, with the number of publications having tripled by 2021, which was until then the year with the highest number of publications. During the period under review, 29.9% (56 articles) were published as open access. This number represents less than half of the total number of publications. The publication in open access increases the probability that the articles obtain greater visualization and, consequently, a greater number of citations, due to their free exposure to readers.

Sustainability, its pillars and indicators are a topic that has been much discussed by researchers in recent years, leveraged by the more frequent approach to sustainable development, which recalls the importance of preservation and rational use of natural resources for the economic, social and environmental good of all. In this context, there is a vast area and research groups in the world involved in studies on sustainability in sugarcane production. The five largest areas of study with an approach to research of this kind include environmental sciences (112 articles), energy (71 articles), agriculture and biological sciences (59 articles), engineering (43) and social sciences (24 articles). Therefore, the results show that sustainability is a multidisciplinary area.

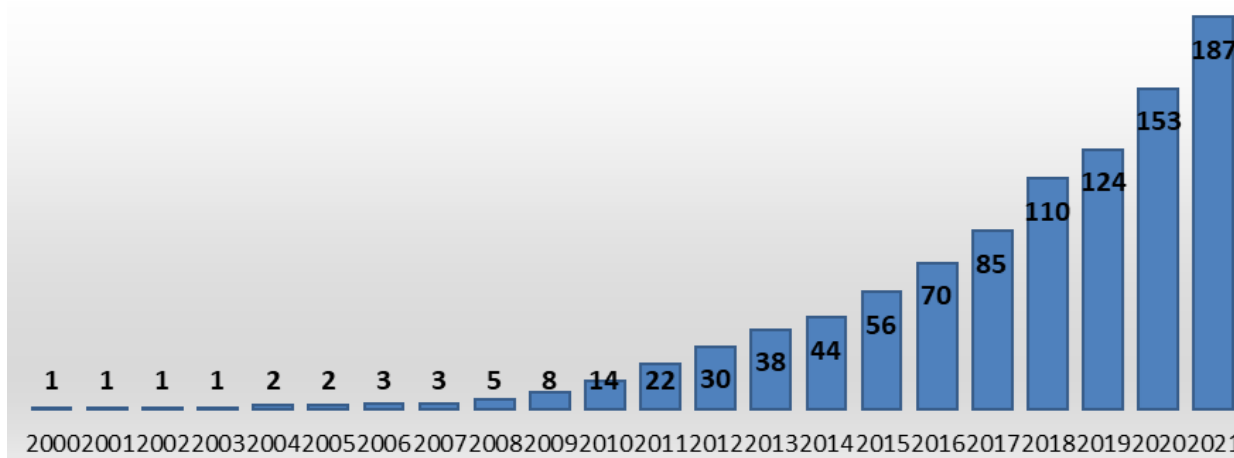


Figure 2. Cumulative evolution of publications

3.2. Leading countries and institutions in publications

Table 1 shows that the five largest countries most involved in research on the sustainability of sugarcane production are Brazil, the United States, Thailand, India and the Netherlands. Brazil and the United States of America contribute with around 56% of the publications, showing that there is great interest from these

countries in research on this matter. Brazil contains the largest number of published articles, and is consciously the largest producer of sugar cane in the world (Cherubin et al., 2021). This result is similar to that obtained by Katia et al. (2019), in the study “What Has Been the Focus of Sugarcane Research? A Bibliometric Overview”, where Brazil was the leader in the number of articles published on sugarcane, with 8431 articles, followed by the United States of America (4174 articles), India (4137 articles), Australia (2455 articles) and China (2086 articles).

With regard to the 5 institutions with the most publications, the State University of Campinas (30 articles), University of São Paulo (29 articles), National Laboratory of Biorenewables (26 articles), National Center for Research in Energy and Materials (19) and King MongKut's University of Technology Thonburi (14 articles). It should be noted that the first 4 institutions are from Brazil and the last from Thailand. The United States of America, despite occupying the second position in countries with the highest number of publications, still has a low number of publications per institution.

Table 1. The five countries and institutions with the most published articles

1 Brazil (8431)	1 Campinas State University (30)
2 United States of America (4174)	2 University of Sao Paulo (29)
3 India (4137)	3 National Laboratory of Biorenewables (26)
4 Australia (2455)	4 National Center for Research in Energy and Materials (19)
5 China (2086)	5 MongKut’s University of Technology Thonburi (14)

3.3. Co-authorship of countries

In the case of the VOSviewer software, the closer the countries/authors are, the stronger their connections. The co-authorship results showed that Brazil is the country with the highest number of associations, with 23 co-authorships, linked to 5 countries. The United States of America (6 links), Thailand (1 link), India (2 links) and the Netherlands (5 links). Australia does not show any co-authorship links.



Figure 3. Co-authored bibliometric map of countries with network visualization

3.4. Word co-occurrence

From the analysis of the co-occurrence of words, the VOSviewer results showed that sustainability (97 occurrences), sustainable development (86 occurrences) and ethanol (59 occurrences) were the keywords that occurred most frequently in articles published during the period in analyze. These concepts, as well as soil quality, water quality, climate threats, emission control, among others, exploded in articles and research at the beginning of 2016, opening up more space for analysis of environmental awareness and the effects of water pollution. management of resources for the life of living beings. Despite low co-occurrence, most previous reviews on sugarcane culture focused more on its products or by-products such as ethanol (Loh et al., 2013; Waclawovsky et al., 2010).

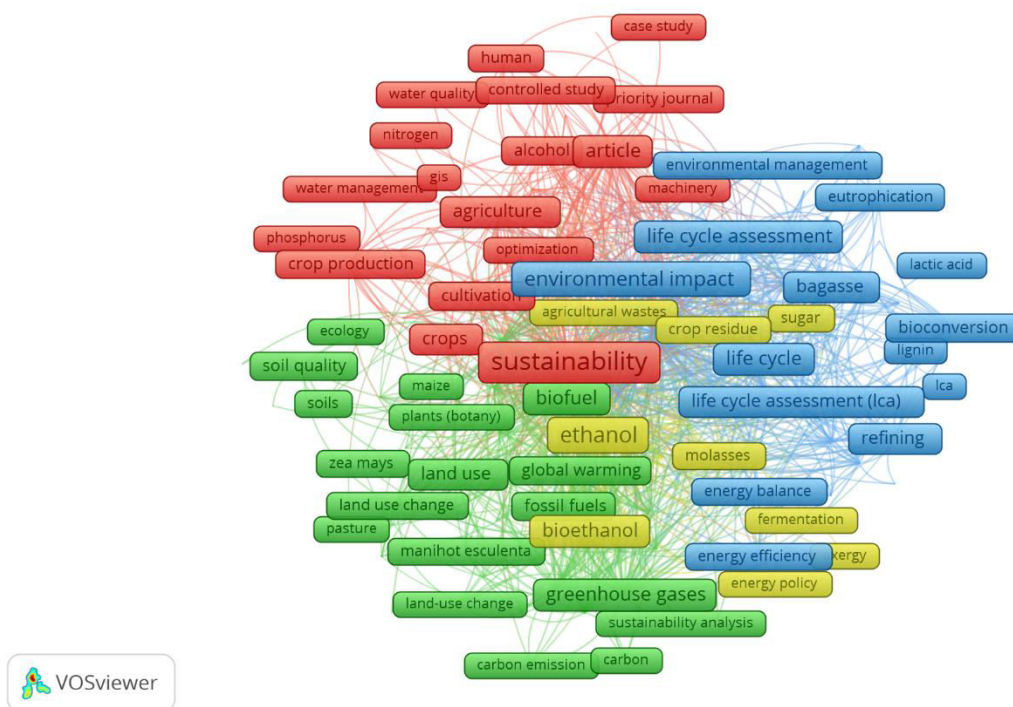


Figure 4. Bibliometric word co-occurrence map

3.5. Most preferred journals

The survey results showed that in the top 5 most preferred journals for publishing studies related to environmental sustainability, Elsevier was the most prominent publisher, with 3 journals followed by Springer Nature and MDPI, both with 1 journal. In descending order of journal productivity, Sustainability Switzerland was the most productive (10677 articles), Journal of Cleaner Production (5127 articles), Applied Energy (1738 articles), Biomass and Bioenergy (348 articles) and International Journal of Life Cycle Assessment (174 articles). Despite having a higher number of publications (reference year - 2000), the cite score of the journal Sustainability Switzerland, MDPI, is much lower when compared to the journals published by Elsevier and Spring Nature. However, there is a need to reflect on this metric, given that Sustainability Switzerland has the lowest cite score, but nevertheless contains a high number of publications and citations, showing that it creates conditions for sharing knowledge generated at a number wide range of users, reflected by the citations presented.

Table 2. Top 5 most productive journals in research on the sustainability of sugarcane production

Journal	TP	TC	CS	Most cited article	NC	Published
Journal of Cleaner Production	5127	203300	13.1	Renewable, non-renewable energy consumption, economic growth, trade openness and ecological footprint: Evidence from organization for economic Co-operation and development countries	244	Elsevier
International Journal of Life Cycle Assessment	174	4981	7.8	Mineral resources in life cycle impact assessment—part I: a critical review of existing methods	42	Springer Nature
Applied Energy	1738	123657	17.6	The state-of-the-art review on energy harvesting from flow-induced vibrations	153	Elsevier
Biomass and Bioenergy	348	1224	6.7	A review on hydrothermal carbonization of biomass and plastic wastes to energy products	82	Elsevier
Sustainability Switzerland	10677	97894	3.9	Impacts of the COVID-19 pandemic on life of higher education students: A global perspective	267	MDPI

TP – Total of publications TC – Total of citations CS – Citation score NC – Number of citations

3.6. Main authors

From the table referring to the 5 most prominent authors in research on the sustainability of sugarcane production, Brazil is the leader with 3 authors, 2 remaining from Thailand and Norway. The first publications of these authors were from 1993 to 2013. Shabbir Gheewala, from Thailand, was the author with the highest number of published articles (251) and h index (47), since 1996. The considerable number of Brazilian authors in the list of the 5 most productive, denotes once again the great interest of researchers in this country in understanding how to guarantee sustainability in the production of sugarcane and remain at the top as the best producer in the world.

Table 3. Top 3 authors with the highest number of articles on sustainability in sugarcane production

Nr.	Author	Scopus ID	FP	TP	H - Index	Affiliation	Country
1	Shabbir Gheewala	6602264724	1996	251	47	King Mongkut's University of Technology Thonburi	Thailand
2	Antonio Bonomi	7004767629	1993	102	32	Campinas State University	Brazil
3	Otávio Cavalett,	9846419000	2005	71	29	Norges Teknisk-Naturvitenskapelige Universitet	Norway
4	Maurício Cherubin	36630011900	2010	114	24	University of Sao Paulo	Brazil
5	Mateus Chagas	55266291800	2013	39	17	Campinas State University	Brazil

FP – First publication **TP** – Total of publications

4. CONCLUSION

The present study generally addressed the trend of research on sustainability in sugarcane production, based on 187 articles selected from the Scopus database, between the years 2000 to 2021. Over the last 6 years, publications on this topic have grown exponentially, with an increasingly constant vision for the coming years, as a result of increased environmental and sustainable awareness in countries worldwide. Brazil is the country with the greatest interest in research related to sugarcane and universities are the main institutions linked to research.

Research on sugarcane production and its sustainability is addressed in many areas, from environmental sciences, energy, agriculture and life sciences, engineering and social sciences, it is, however, a multidisciplinary subject. There are few publications that clearly address sustainability by looking at its three pillars (economic, social and environmental). Most studies address sustainability in terms of products derived from sugarcane and not necessarily the sustainability of production. At the level of African countries, there is little research done in the area of evaluation of sugarcane sustainability indicators, and none of them are in the top 10, showing that there is still much to be researched in relation to this topic.

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INDIGENOUS KNOWLEDGE MANAGEMENT SYSTEMS (IKS): ZIMBABWE'S SUSTAINABLE GROWTH STRATEGY

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ABSTRACT

The society is suffering not just because of the rascals the mischievous people, the society is also suffering because of some of us good people who are doing nothing to share what we know, to turn our indigenous knowledge systems in being the hub of our economy. Indigenous Knowledge Management Systems (IKS) is of great essence to the society through for example conserving the environment, developing sustainable agriculture and ensuring food security, while its protection encourages the maintenance of traditional practices and lifestyles. The preservation of the indigenous systems protects our cultural heritage, hence bringing in foreign currency through tourism and exporting. Our own natural plants, dances, the culture, songs, and beliefs can make Zimbabwe, one of the richest country in the world. This article through the use of literature, interviews, document analysis and observations will bring out different categories of indigenous knowledge systems and their benefit to economic development and sustainability. The Aloe vera (gavagava), Annona (Muroro), Clausena anisata (Muvhengahonhye), Docomanomala (Chifumuro), Erythrinaabyssinica (Munhimitimbi), Ziziphismucronata (Muchecheni), Ximenia caffra (Munhengeni), Lanneaedulis (Mutsombori), Pterocarpus angolensis (Mubvaropa), Vangeueria Infausta (Mutsviru), Ximenia caffra (Munhengeni, the shell of the baobab tree, Zumbane and more are the Zimbabwean traditional herbs that bring both health and wealth to the nation. There is therefore need for the proper use of intellectual property laws to preserve our natural heritage. This then brings in the idea of documenting traditional knowledge as one of the potent means of protecting it from extinction at a time when indigenous systems are being marginalized by dominant societies resulting in assimilation and cultural genocide in the name of globalisation. This then results in putting a value of the documents for economic benefits. Our artifacts, riddles, nganos, folklores can be repackaged for cultural and economic value and can be traded in the global village. Zimbabwe's traditional cultural expressions or folklores of conversation are tangible and intangible forms in which traditional knowledge and culture are expressed communicated and manifested for example, traditional songs and dances, performances, crafts, names among others are of great sustainable competitive advantage. Zimbabwe is also rich in traditional dances and songs which also bring in foreign currency. The article also shows challenges and mitigatory measures in the protection and promotion of or indigenous knowledge management systems.

Keywords: Indigenous Knowledge Management Systems IKS, knowledge management, preservation, globalisation, herbs, cultural expressions

INTRODUCTION

The sustainability of a nation, depends on its indigenous systems. Local problems can best be solved by the indigenous knowledge systems. knowledge can help find the best solution to a development solution. When, in 2015, the international community agreed on 17 Sustainable Development Goals (SDGs), a set of targets for improving lives while protecting natural resources by the year 2030, they included specific mention of indigenous peoples, and acknowledged that there can be no truly sustainable development without protecting the traditional knowledge and territories of indigenous peoples (sdg.iisd.org). The Indigenous Knowledge Systems (IKS) forms the bases on our sustainable economic development.

STATEMENT OF THE PROBLEM

Our challenges are that we have indigenous knowledge that we can use to sustainable develop our economy, however we are not fully utilizing it. We are actually borrowing expensive methods from elsewhere as if we do not have our own indigenous knowledge that can spur our economic growth.

WHAT IS INDIGENOUS KNOWLEDGE MANAGEMENT SYSTEMS?

Mugabe (1998) defines Indigenous Knowledge as knowledge that is held and made use of by people who regard themselves indigenous to a particular place. Betsie (2007) notes that indigenous knowledge is part and parcel of the culture and history of any local community and that, for any development programme to occur, people must build on from what local people know. Indigenous knowledge systems are a body of knowledge, or bodies of knowledge of the indigenous people of particular geographical areas that they have survived on for a very long time (Mapara, 2009). Matsika (2012, 209-210) defines indigenous knowledge (IK) as: 'the traditional and local knowledge that exists and is developed through the experiences of the local community in the process of managing the conditions or context that challenge the people's everyday life'.

REVIEW OF RELATED LITERATURE

Nyumba (2006) notes that as African people our lives are greatly affected by indigenous knowledge, for example, we rely on it for medicinal and herbal needs, food supply, conflict resolution and spiritual growth. Indigenous knowledge is indeed the cornerstone for building our own identity and ensuring coherence of social structures within communities. Sithole (2006) notes that since indigenous knowledge is mostly stored in people's minds and passed on through generations by word of mouth rather than in written form, it is vulnerable to rapid change. There are a number of factors that contribute to the loss of indigenous knowledge, for example, development processes like rural/urban migration and changes to population structure as a result of famine, epidemics, displacement or war may all contribute to loss of indigenous knowledge. Nyumba (2006) notes that indigenous knowledge is under threat from modern technology because even in remote areas the powers that push global or just non-local content, such as, radio and television broadcasting, advertising, among others are much stronger than those pushing local content. Web 2.0 thus social media is pushing stronger than indigenous knowledge management systems. World Bank, (1998) notes that indigenous knowledge faces extinction unless it is properly documented and disseminated.

However, Mapara (2009) observed that wealth of medical knowledge, that not only sustained their populations prior to colonisation, but that also continued to be relied on long after the colonies had been set up. Among the Shona of Zimbabwe, when one was suffering from malaria, there was the use of plants like chiparurangoma (*Borreria dibrachiata*) as a form of treatment. It was administered orally and one was usually healed of the ailment within twenty-four hours. The Shona also used the shrub called *Muvengahonye* (*Canthium huillense*) to treat and heal wounds that had become septic on both human beings and livestock. Other plants like *chikohwa/gavakava* (aloe) were and continue to be used to heal people who are suffering from ailments. The same plant was, and in some places continues to be used as preventive medicine for Newcastle disease in chickens. Among the Manyika, the *mumwahuku* plant's leaves (*Cassia didymobotrya*) were pounded and mixed with water to prevent chickens from being affected by *Chitosi* (a type of poultry sickness). Another plus that sets indigenous medical and veterinary practice ahead of the Western one is that which Emeagwali (www.africahistory.net) highlights. She points out that African Traditional Medicine (ATM) is holistic since it makes attempts to go beyond the boundaries of the physical body into the spiritual. She contrasts the two types of medicine by pointing out that bio-medicine is mechanistically derived from the germ theory of disease, while on the other hand ATM can be classified as mind-body medicine.

Munodawafa (2011) a lecturer from African University conducted a study on "Anti-microbial and Phytochemical Screening of some of Zimbabwe's medicinal plants" in order to assess the healing properties of plants. The scientific study was done in collaboration with traditional healers from Manicaland and Matabeleland and a botanist from the National Botanical Gardens. The researchers made use of the bark of twelve medicinal plants, namely; *Annona* (Muroro), *Clausena anisata* (*Muvhengahonye*), *Docomanomala* (*Chifumuro*) *Erythrina abyssinica* (*Munhimitimbi*) *Ziziphus mucronata* (*Muchecheni*), *Ximenia caffra* (*Munhengeni*), *Lannea edulis* (*Mutsombori*), *Pterocarpus angolensis* (*Mubvaropa*) *Vangueria infausta* (*Mutsviru*), *Ximenia caffra* (*Munhengeni*). The researchers tested for antimicrobial activity against four bacteria and two fungal species through the use of agar diffusion method. The largest zones of inhibition resulted from the plant extract *Pterocarpus angolensis* (*Mubvaropa* root against *Escherichia coli*. The researcher found out that the larger the zone of inhibition, the more potent the traditional medicine. Some of the plants investigated included *Clausena anisata*, *Rutaceae* (*Muvhengahonye*) used to treat diabetes, rheumatism, migraine headaches and worms and the use of *Dicoma anamola*, *Asteraceae* (*Chifumuro*) used to treat stomach pain, colic, diarrhea, syphilis, gonorrhoea, sore throats and coughs and colds. Munodawafa notes that if a plant contains saponins it can be speculated that it can be used as a laxative "...to induce bowel movement or to relieve constipation". The researcher noted that each plant under investigation contained metabolites, for example, they applied plant extracts on micro-organism associated with Gonorrhoea and it was proved that the growth of micro-organisms was subdued. This validated that the claims made by traditional healers with regards to the plants was true.

Zimbabwe is cultural rich terms of traditional cultural dances. In Zimbabwe, dancing is an important aspect of the culture, tradition, spirituality and history. There are many dances that reflect the culture of the people, although the dances may have changed throughout the years. These dances, for example, *jiti*, *mbakumba*, *mbende* among others reflect the wealthy Ethnic diversity of Zimbabwe. These dances can be effectively utilised for our nation's economic benefits as well as bringing foreign currency and boosting tourism. These dances and songs can be exported as well as traded via the digital technologies in a way of marketing our country and bring investor confidence.

Gadaga et al (1999) found out the major Zimbabwe traditional beverages and fermented foods processing technologies was at its infancy. These fermented products included; fermented milk (*hodzeko*, *mukaka* or

amasi), fermented maize porridges (ilambazi lokubilisa or mutwiwa), sorghum or millet malt alcoholic beverages (chikokiyana, doro or uthwala), cereal-based non-alcoholic beverages (mangisi, mahewu and tobwa), fermented fruits mashes (makumbi) and distilled spirits (kachasu). They further recommended to increase study of biochemistry and microbiology technology as well as documentation for preservation. They found out that these were produced only at household. Pswarayi and Ganzle (2019) found out the origin and composition of microbiota fermentation of maheu and other beverages. Chawafambira, Nyoni and Mkungunugwa (2021) also found the composition of producing mutwiwa or fermented maize porridges. These researches are on the basis that we now have these technologies in producing quantities that only satisfy the local Zimbabwe market. It is the purpose of this study to encourage commanding strategic management for mass production engineering for international and global markets. The main focus is to grow international engaging in mass marketing. Preservation of traditional foods processing methods and mechanise for mass production.

According to Paradise (2022) the most popular traditional foods in Zimbabwe consists of: maize meal (sadza/ itshwala essential for exporting the mealie meal), yellow watermelon with sun-dried maize (umxhanxa/ mxan'a), mutakura / mangai (peanuts, maize and beans dish), nyemba, Nyimo, yams (madhumbe /magogoya), harurwa, ishwa/imbhombo, mopane worms, pumbkins, (make pumpkin pudding i.e. nhopi / inhopi), dried greens (African spider flower leaves/ mufushwa wenyevhe/ ulude), roasted maize (mhandire /umumbu), and bamboo sweet juice (icelolo). Mabika (2021) also gave these lines but had earlier an addition to this list consisting of okra (derere), mupunga une dovi, pumpkin leaves (muboora, sweet potatoes (mbambaira) and baked ground corn (chidhudhu). The was only a list of these foods but this research focuses on how to make these traditional foods for country sustainable growth.

METHODOLOGY

This study is a qualitative research. It used convenient sampling to gather data and the existing literature. The research instruments used were interviews and document analysis and observations. Fifteen people were interviewed particularly on the use of traditional herbs and for other cultural expressions like ngano and tsumo, the researchers analysed the really ngano and tsumo.

FINDINGS

The following findings were presented:

Dances

Participant 012 alludes that Mhande is the dance used for Karanga rituals that involves their ancestral spirits. Rituals such as appeasement of the ancestors on ceremonies such as first fruits, rain making, kurova guva etc. It is therefore a dance of places like Masvingo and Midlands provinces and other spaces where people from the Karanga society are concentrated like Muzarabani, Mokonde, Hurungwe areas where Karanga people migrated to.

Songs

Murape (2019) avers that Songs are another tool that was used as a form of education. They could be used to memorise the qualities of a good wife/husband as is given in the songs "Sarura wako" (Take your pick) or to teach about chiefs and trees that are found in one's area of residence as is given in the songs "Dudu muduri" and "Tsatsa ndikatsandika." When these forms of education are compared to the Western ones, for example the English nursery rhymes and songs, it can be observed that these do not relate to the African child's experiences. In fact, the education that Blacks have inherited from the West has not empowered them, but has incapacitated them and has sold them the lie that they should be employed to make progress in life and to raise the standard of living. This education is quiet of the importance of the quality of life over the standard of living. It is just an education that has turned Blacks into a proletariat. Jerusalem New beats by Duglas Vambe showed great indigenous beats talent imbedded in the Zimbabwean people. Such type of knowledge boots the Zimbabwean economy through international marketing.

Yoweree mudzumu dzoka

It is a way of embarrassing the spirit of our fore fathers to guide us and protect us. In whatever we do. Our is greatly affected in a negative (ine mamota). We have deviated from our traditional norms. The marange diamonds.

Nhema musasa

Iwe nhema musasa. Karinge zuva nhamo ichauya, Havanzvadzi yaamai vako zvaisinga rime. Songs and dances are a collective effort of the community. The rights reside with the indigenous people. The question is how can this knowledge be harnessed and repacked to bring economic growth? It bring forex. Lets take a leaf from Carnivals eg Brazilians.

Indigenous Herbs

In response to the interview question on the effectiveness of the indigenous herbs and how we can economize them, the following responses were presented:

Participant 02 opines that preservation, conservative resource centres should be established for the cultural heritage. Society should be taught about value of trees and herbs then engage medical facilities on establishing facts on the effects of traditional medicine, older generations should be able to pass knowledge from generation to generation. Participant 05 argues that recently, specifically in the wake of the COVID-19 pandemic, it has been noted that indigenous medicine such as zumbani, lemons, guava leaves and eucalyptus are very efficient in fighting flue-related diseases. Participant 06 asserts that there are many various types of common indigenous medicine being used to treat different ailments across Zimbabwe. Some are prescribed by traditional healers and are very effective in treating and curing. With the wake of the *herb industry* people are starting to realize that traditional medicine is very helpful. If properly utilized and economized, traditional medicine will greatly impact both the health and economic sectors positively as these will be easily available, with affordable prices. These medicines can also bring foreign currency into the country if properly economized. Participant 07 avers that there is need for proper packaging, verification through researches, testing and approval, device appropriate doses, define mode of inoculation/curing/treating and regulate indigenous medicine. Participant 01 mentioned the role of muchedza ambuya in cleaning the human system.

Participant 013 was not willing to open unfortunately, “I cannot give my knowledge for free. Please visit me and pay, thereafter I share”. The aspect that some participant was not willing to share their knowledge as they were afraid that their knowledge can be copied. Participant 014 suggests that Government must grant permission to those who are willing to sell them. There must be an open policy of willing seller willing buyer. The trust of the patients upon the traditional medicine should not governed by government like what was happened to Prophet Magaya when he introduced his Aguma herb..the government intervened with it's strict deter control measures. Participant 010 alludes that “our traditional herbs are always available. Like for an example most people living in Masvingo Gutu, Chipinge they are used to take natural herbs therefore their life expectancy is 80years. In comparison: most people who are living in Mashonaland their life expectancy is low, and there is high infant mortality rate due scarcity of herbs and other beliefs. No side effects and I think are the best over others”. Participant 08 notes that let's make sure we protect our forests first especially the sacred ones. Let's do a thorough research of medicinal uses of trees and herbs. Let's encourage packing and labelling. Government and cooperate world should support herbalists and traditional healers financially. We need to see more partnership btwn herbalists and Chinese Tiens and Green World. We should institutionalized sacred forests, educate herbalists to university level...herbs exhibitions, competitions and festivals. I think you need to also acknowledge the shortcomings of traditional medicine that is not backed with scientific approval. Some of the shortcomings are lack of dosage quantities, no time frame for taking the medication, no certification from scientists. Participant 011 calls for economizing,

“Sezviri kuitwa mazuvano mamedicines such as traditional herbs akuisa mumaPharmacies kana maCentres akaita sana 1202 zvinoita vanhu vatenge pachirungu kubviswa pfungwa iye yekuita sevari kubatsirwa kwasekuru. Mamedicines aya anoshambadzwa achiburitsa zvaakanakira kunyanya uye kurapa kwayo asiri processed kwakanyanya nekuti anenge asi kutapudzwa simba rawo”. Thus we need to economise our indigenous systems like the traditional herbs. It was pointed out that muuyu boosts immune system. The shell of muuyu treats teeth arch. We need to have a plantation of mauyu. The nets of mauyu can be used to produce real nets. Mutsime cleans the system.

Participant 013 alludes that Muto wedamba ganga unorapa tsanga yemombe uye unoshayisa uturu hwedzimwe nyoka kana munhu zviya arumwa nenyoka. Shoko (2017) alluded that The chifumuro root is tied onto a fiber or a string prepared from the bark of a tree that the diviner recommends after diagnosing the illness. This is then tied around the neck or waist. Strings around the waist dumwa and/or necks of children are a common sight. The medicine tied onto the string is thus both curative and preventive. Although chifumuro is limited to a specific disease, it acts as a safeguard against illness in children. The illness called nhova.

Role of Ngano (Folktales) proverbs in sustainable development

Ngan

(folktales) are basically stories that are told as a form of entertainment but at the same time aimed at educating the audience. They are usually told after supper before bedtime around a fire, because this is a common rest time that people are relaxed and can be telling each other stories. Children however can be found telling each other ngano anytime. In between the tale there can be a story and the narrator usually sings it and all the people listening join in to the singing. In its traditional sense ngano had the role of bringing unit in the families,

communities hence sustainability as there is oneness. Ngano inspires and motivates audience hence productivity increases in so doing providing knowledge for development. Knowledge shared is knowledge multiplied, the use of knowledge does not consume it. The transferal of knowledge does not result from losing it (Dalkir, 2005). **Folktales** can also help in correcting wayward behaviours within the community. Charity begins at home. Ngano plays a role in reducing corruption as ubuntu is built from the womb to the tomb, from cradle to the grave thus catching them young. Folktales also brings empathy.

As demonstrated by the ngano of the animals digging the well to reach the water table during water crises, problems are solved. Each animal group was invited to the zunde for the digging of the water well. It teaches that, all people should be given opportunity to rescue the economy from the doldrums. Each animal group has a skill that can be employed to rescue the economy from collapsing thus teamwork and team learning is of great necessity to solve the economic challenges and to work towards sustainable economic development. From this Folktale, justice system should be aware of tricksters and corrupt people displaying Tsuru's tendencies. If not alert, it would not be easy to weed out corruption in the country. In the development of our nation, we should not look down upon each other, even though Tortoise was looked down upon, he managed to reach the water table. The tortoise was given a chance to prove his mettle. He brought the water and also was the one who arrested the trickster Tsuru. It is not those with physical power who should be entrusted with the role of bringing justice and stop corrupt activities. Allow those who have nothing to avenge or revenge lead the justice process. Collaboration of different views should be considered so that the problem is addressed.

Mapara (2009) assets that among the Shona these teachings are usually preceded by the words: “Vakuru vedu vanoti ...” or “Vakuru vedu vaiti ...” (Our elders used to say...”or “Our elders say...”). The appeal to the vakuru who may belong to the dead or are very much advanced in age also comes from the Shona proverb that states, “Nzira inobvunza vari mberi.” (Literary: You should ask those who are ahead for directions to your destination, viz: You should ask the experienced for assistance). **Proverbs** were also used to inculcate in the youngsters a sense of responsibility. For example, among the Shona, a youngster could be advised not to waste time on issues that had no value. An elder could say to her or him, “Gunde repwa rinonaka asi hariiswi mudura” (The green stalk of maize may be sweet but it cannot be harvested and stored in a granary). From what is in this proverb, it is clear that the youngsters were taught using examples of experiences that they may have gone through or observed. Proverbs also encourage team work Chara chimwe hachitswanyiri inda. Zano ndega akasiya jira kumasese. Ndarira imwe hairiri. Madikira/metarphos also have a role in encouraging hard working through discouraging kukohwa pamusakarima, kudya mari, umbimbindoga, kuteya mhopo.

Riddles

were also used to foster quick thinking on the part of the youngsters. Riddles have proven that IKS are not something that is static, but a form of education and entertainment, that some people today call edutainment, that is a combination of education and entertainment. Lusweti (1984:30) makes clear the objectives of riddles when he states that there is a type of art form that involves metaphorical or poetic comment on things within the environment. He further states that riddles are closely related to proverbs, but they are usually meant for the education and entertainment of children. Youngsters would be entertained through their creative prowess as they create proverbs like, “Vasikana kundurai marokwe tinakirwe” (Girls, pull up your dresses so that we can enjoy ourselves). The answer to this riddle is “Bananas”. The idea that is captured in the riddle is that one has to remove the cover of the bananas, which are represented by the dress in the riddle. Another riddle could be kuenda kumbangu kudzoka humbanhu (Going forwards and backwards) and the answer to this was sasa meaning door. It shows that in our tradition we also embrace Mathematics thus our Maths in Shona. Among the Gikuyu, there is the riddle “Ndathii na m ã nd ũli tenjii ř a hurũka!” (I walk with a companion who will never tell me to rest!) It refers to a shadow (Lusweti 1984:32). The children in the examples above learn about their environment but in an entertaining way. In economics we learn about environmental analysis, the internal and the external environment. It can easily be picked that this is now the internal environment which we can easily control just like opening and closing a door kuenda humbangu kudzoka humbangu. It follows that economics is also taught through Indigenous Knowledge Systems (IKS).

Taboos (zviyera)

were also used as a way of minimising the raids from baboons. There was the taboo that people were not supposed to harvest all wild loquats (mazhanje) because if they did so it was taboo. The main reason was that baboons feed on these fruits among other food items that they identify, if they found no mazhanje and then they would raid people’s fields. If mazhanje were available, their raids could be kept at bay for some time and they would not destroy new crops like maize that could as young as a week old hence leading to economic development. The is a taboo that says that if you stay on road you will develop an abscess. Ukagara munzira

unoita mamota contemporary it said kugara mumugwagwa unotsikwa nemotikari kana nebhazikoro. This chiyera is linked to the economic challenges that we are facing now. Our money is seated on the roads (kugara mudzira) and the economy is suffering from abscesses (mamota). Our money should be moved away from the streets to its rightful place as it is our economy will remain with abscess. There is need kutumbura mamota. It is painful kutumburwa mota but when it is done mutumburi nemutumburwi tose tinofara. A taboo is ‘any ritual prohibition on certain activities...It may involve the avoidance of certain people, places, objects or actions’ (Jary and Jary, 1995:677). Mapira and Mazambara (2013) opine that some places were regarded as sacred and could not be molested by human activities. Taboos were used in order to protect or safeguard certain resources against possible damage. Consequently, they were kept in their natural state for centuries without being degraded by human interference. Examples drawn from this study include: mountains, rivers and water bodies, monuments, forests, caves and veld resources. These resources are our sustainable economic resources.

Preservation of our natural resources

The indigenous people have that knowledge for weather forecasting. Kana kuine mubvumbi, kana murove, gunguwo rikarira zuva rinobuda. A sign of the end of the cyclone. When there is too much hacha and mazhanje is signifies hunger. The indigenous people would not wait for drought to occur, they will organise for mukwerere and surely rain falls. Kugara et al (2022) opines that The knowledge of local and indigenous peoples, commonly mentioned to as local knowledge systems (LKS) or indigenous knowledge systems (IKS), is gradually being recognized as an imperative source of information for climate mitigation and adaptation. It is essential that policymakers draw on the best available knowledge in the face of global climate change.

Chisi chako masimba mashoma-buying in is needed. What if foreign is not ours therefore, not sustainable. So there is need to invest in ways that sustain our economy for example land is the backbone of our economy. Land is ours what are we using it for?. Some of us are actually putting foreign investments where are we going, our ancestors, the owners of the land they will never be pleased. For example, in Chiyanzwa, the local people unknowingly where on living on ngoda when foreign investment came ngoda disappeared. Ngoda can hear and sense. The **Constitution of Zimbabwe (2013) Section 13 (4)** on National Development states that the State must ensure that local communities benefit from the resources in their areas. This is supported by the **National Development Strategies (NDS1)** hence leading to the attainment of vision 2030- Zimbabwe to become an Upper-Middle Income Economy by 2030. This will make devolution conspicuous.

Mutupo system plays a greater role in the preservation of the environment. It is taboo to eat your totem, you lose your teeth the reason is to preserve our natural resources. (Kudy mutupo wako unobva mazino). There are certain principles that we are not supposed to break. We do not also marry someone with the same totem if you do that you are eating your totem. We are not even supposed to even marry from the same totem if done you pay cheka ukama a white cattle of which its very rare to find it which would restrain people from marrying from the same totem.

The role of Njuzu in the preservation of the environment

The places where marine spirits reside are water bodies especially wet lands. These places are sacred and the water is also a sacred commodity. The moment we disturb the wetlands we are disturbing the guardians of clean water and by doing we are also disturbing the economy as without water, the economy cannot flourish. Water is the new gold. Once the wetlands are disturbed the result is dirty water. If we have dirty water, then more and expensive chemicals are needed to clean the water. This money can be channelled to motivate the employees or other economic income generating projects. Right now at Chirorodziva (Chinhoyi Caves), the water is blue as the place is sacred and protected.

Njuzu (marine beings) help in the preservation of wetlands and the surrounding indigenous forests. Researches that are at our disposal focus more on how evil and mythical is the belief of njuzu existence. Little has been done in interrogating how the belief in njuzu can be beneficial used in safeguarding our natural resources if it is merged with the scientific ways of mitigating the effects of climate change in Africa with a particular focus on Zimbabwe. The marine spirits have a role in the preservation of water resources and forests.

Forests play a crucial function in regulation of the hydrological cycle. According to Timberlake and Shaw (1994) the Chirinda forest, found in South-East Zimbabwe, extracts moisture from the air and makes the area which it clothes relatively wet, compared to the surrounding areas. Also forests are crucial in environmental protection. Apart from curbing erosion and the siltation of watercourses and reservoirs, forests indirectly protect aquatic habitats, especially spawning grounds for fish and other aquatic organisms. In fact, forests are an integral part of the earth’s life support systems. However, according to Mukwada (2000) the demand for forest and woodland products has increased over the years. This demand has been matched by a corresponding rise in

the consumption of forest products. In developing countries where traditional fuels still constitute the greatest proportion of the total energy consumed, fuel wood supply has already been outstripped by demand. Thus, this rise in forest products demand has contributed immensely to forest mismanagement such as deforestation and subsequent degradation of the land.

Language and economy

As language conveys Indigenous culture, the more a researcher knows and understands the language of the community, the better the chances of creating a trusting relationship with community members. It is important to know your indigenous language as it helps indigenous to understand each other and quickly grasp the concepts of development. Let take Great Zimbabwe it was built using indigenous knowledge systems. Ngũgĩ wa Thiong'o (1981) dedicated his book *Decolonising the mind* to all those who write in African languages, and to all those who over the years have maintained the dignity of the literature, culture, philosophy, and other treasures carried by African languages. He goes on to say that imperialism continue to control the economy, politics and culture from that Euro-American based stronghold to usher a new era of the communal self-regulation and self –determination. It is an ever-continuing struggle to seize back their creative initiative in history through a real control of all the means of communal self-definition in time and space. The choice of language and the use to which language is put is central to a people's definition of themselves in relation to their natural and social environment. Our language is rich and interesting. We need to decolonize the mind (Ngũgĩ waThiongo). Dr Ignatious Mabasa wrote his PhD in Shona.

Indigenous Food

Fresh ingredients, exotic meats, and indigenous recipes all define **Zimbabwean food**, some of the most unique and fascinating dishes in Africa. It was observed that Zimbabwean's indigenous food like madora, mutakura, mbirembire, mutete, sadza rezviro, sadza remhunga, derere etc can be commercialized and also marketed in foreign countries to boost the Zimbabwean economy. Zimbabwean food has no chemicals and therefore healthy for the body. Our indigenous people lived for so many years as they were eating healthier food.

Challenges of Indigenous knowledge management systems (IKS)

Chavunduka (2004) notes that the protection of traditional knowledge faces challenges when it comes to patenting and intellectual property rights. He further notes that foreign researchers can appropriate traditional knowledge and apply for a patent, claiming to have invented a new product since traditional knowledge has attributes of communal ownership.

Threats to specialist. Those with the indigenous knowledge fear to share what they know as they are economically benefiting them at an individual level. Lack of documentation. Indigenous Knowledge Systems were often passed from generation to generation hence there is a tendency of missing some of the crucial information through forgetfulness, exaggeration and distortion. There is lack of intellectual property protection systems that can name the source of genetic material or traditional knowledge used in product discovery. If the IKS is tacit and not explicit, it becomes difficult to share hence need for documentary, socialization, coaching and mentoring as well as Sui Generis knowledge sharing strategies. There is also need to preserve through the use of Information and Communication Technologies (ICTs) like Google Drive and Cloud Computing.

RECOMMENDATIONS

- Documentation of Knowledge Systems. If IKS is not fully documented, it faces extinction. The documentation of indigenous knowledge should be done in with due consideration of the legal and ethical challenges that emanate from dealing with knowledge that is communally owned.
- Harness knowledge systems for sustainable knowledge.
- Repackaging to sustain ourselves and trade globally. There is need to repackage this knowledge for wider distribution for the benefit of humankind, formulation and enforcement of legislation to protect indigenous resources against bio-piracy and promoting scholarly research in the use of such resources.
- There is need for documenting traditional knowledge as one of the potent means of protecting it from extinction at a time when indigenous systems are being marginalized by dominant societies resulting in assimilation and cultural genocide in the name of globalisation.
- Money should be moved from the streets to its rightful place which are banks as it is our economy will remain with abscesses.
- There is need for Patents to safeguard against theft.
- IKS policy is called for

- Our artifacts, riddles, nganos, folklores can be repackaged for cultural and economic value and can be traded in the global village. They can even be traded for economic through the use of web 2.0 through Tik Tok, Instagram, face book, WhatsApp etc. They can reach out to everyone through e-business, e-commerce and global technopreneurship. Web sites can be designed whereby clients at the comfort of their homes can pay for whatever traditional dance and song video they want, 20c click for video if the target is the whole world is a lot of money for Zimbabwe.

CONCLUSION

The article demonstrates different indigenous knowledge sections and identify how these sections can be utilised for the economic development. These sections include herbs, language, ngano, riddles, dances and songs, preservation of nature and indigenous food. It was observed that the Zimbabwean is infected by abscesses. It is painful to remove pass from an abscess (Kusvina mamota kunorwa) but it has to be done so that we achieve sustainable economic development and at the same time achieving vision 2030.

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PERSON-ENVIRONMENT FIT- A PROACTIVE APPROACH FOR OCCUPATIONAL STRESS IN BANKING SECTOR

¹Rinakhanum and ²Prof. R. Hiremani Naik¹Research Scholar and ²Professor, MBA Department, Kuvempu University**ABSTRACT**

The work related factors are more negatively influential to the work place as well as the performance of the people in the organizations. The roles, responsibilities of the industries are different because of their nature of operations, with this working environment is also different, and the organizations hire the suitable candidates for the work operations. But the facts such as employee turnover will not reduce after taking the suitable measures with this the people in the organization face the work related problems. This is due to incompatibility between the Person and the Work Environment. Especially in the banking sector, it was said in the many research studies that the employees of the banking sector have problems related to the personal as well as professional factors and that leads to have imbalance between the employee and the organization environment. Certainly people of the organizations require adjusting with the work environment to get rid of the problems. In the light of the same the study intends to examine the Person-Environment Fit approach to know how the role of perceived Person-Environment fit approach connects the person with the environment. This study is descriptive and exploratory in nature; the required data for the study purpose has been collected from the bank employees.

Keywords: Person, Environment, Stress, Banking sector,

INTRODUCTION

The alignment of an employee's personal traits with his or her working environment is known as person-environment fit. Human resource and organisational behaviour research is a well-known field that focuses on various notable outcomes in various stages of people's work-life cycles. People look for and select careers early in their careers that might be compatible with their self-concepts as well as their primary interests (Holland, 1985). Similar to this, during the employment search and selection processes, candidates select among the available options based on their perceived fit with particular jobs and organisations (Cable & Judge, 1997). Long-term attitudes and behaviour outcomes, ranging from job and career satisfaction to turnover goal and actual turnover behaviour, are greatly influenced by an individual's fit with various aspects of the work environment (O'Reily, Chatman, & Caldwell, 1991). Employees' compatibility with various workplace variables over the long term affects a variety of attitude and behavioural outcomes, from employment and career fulfilment to turnover target and actual turnover behaviour.

Person-environment fit is the degree to which individual and environmental characteristics match. Person characteristics may include an individual's biological or psychological needs, values, goals, abilities, or personality, while environmental characteristics could include intrinsic and extrinsic rewards, demands of a job or role, cultural values, or characteristics of other individuals and collectives in the person's social environment. Due to its important implications in the workplace, person-environment fit has maintained a prominent position in Industrial and organizational psychology and related fields.

Fit between a person's characteristics and their environment is referred to as person-environment fit. Environment characteristics could include intrinsic and extrinsic rewards, requirements of a job or role, cultural values, or traits of other people and groups in the person's social environment. Person characteristics could include a person's biological or psychological needs, values, goals, abilities, or personality. The importance of person-environment fit in the workplace has kept it at the forefront of industrial and organisational psychology and related fields.

A person's job-related psychological stress is known as occupational stress. Occupational stress is a chronic illness. By identifying the stressful work environments and taking action to change them, occupational stress can be controlled. When employees feel unsupported by their managers or co-workers, feel like they have little control over the work they do, or discover that their efforts on the job are insufficiently rewarded, occupational stress can develop. Because stressful work environments are linked to employees' emotional well-being, physical health, and job performance, occupational stress is a concern for both employees and employers.

The above said factors which cause the occupational stress that exactly mean that there is an imbalance between the personal factors as well as the environmental factors. Hence, it requires having a very good combination between the people as well work environment.

LITERATURE REVIEW

Angela K Miles and Pamela L Perrewe (2011), opined about the relationship between Person-Environment Fit, Control, and Strain. The major emphasis of this study is on the role of ergonomics in reducing the dysfunctional personal and work outcomes, because the job dissatisfaction and the job tension influence to have the imbalance between the Person and Environment. The findings of the study reveals that there is positive relationship between the ergonomics design and the perception of the Person-Environment and also its control, and it was also discovered that the Person-Environment Fit had a negatively related to the job tension and dissatisfaction. This study ably produced the impact of ergonomics on the organizational stress at the work place, and it is used as the means to prevent the stress.

Annelies E M, Van Vianen (2018), In this article the author highlights the three principles of person environment fit firstly both environment and person all together forecast the human behaviour, secondly there is an optimal results when there is a good compatibility in the personal attributes such as needs and values, and thirdly the misfit between the person and environment does not matter. In this study the efforts has been made to know the effects of person environment fit, where as it was discovered that the people in the organization said that there is high optimal efficiency when there is person and environment fit and there is low efficiency when there is low person environment fit.

Pei Liu, Xiao Tian Wang, Aimei Li, and Lei Zhou (2019), the authors have made the study entitled “Predicting Work-Family Balance: A New Perspective on Person-Environment Fit”. From a person-environment fit perspective, this study explores whether organisational resources and preferences for work-family integration jointly influence work-family balance and distal family-related outcomes like marital satisfaction and family functioning. The polynomial regression analysis was made to test the hypothesis. The findings demonstrate that when work-family integration preferences and organisational resources are in line, as opposed to being at conflict, employee work-family balance is higher.

Fabian O Ugwu and Ike E Onyishi(2020), has conducted a study on moderating role of person-environment fit on the relationship perceived workload and work engagement. For the purpose of the study the data was collected from the 216 hospital nurses. The regression analysis was made to know the relationship of the perceived work load and the work engagement. Hence, it was revealed that there was a significant and negative relation between the work engagement and the perceived high work load. But there was an insignificant moderating effect in relationship between the work engagement and the high workload due to the effect of Person-Environment fit approach.

Yingxin Deng, Xiang Yao (2020), has made a study on Person Environment fit and proactive socialization: Reciprocal relationships in an academic environment”, this study is the complete integration of the person and environment fit as a proactive measure for the socialization of the behaviour. The person-environment fit is positively influenced to have the various factors in the employees such as relationship building and general socialization for the optimistic self management.

Jeffrey R Edwards (2017), discussed the role of Environment fit approach in reducing the stress. The focus of this study is on the two versions of the Person-Environment Fit approach to stress, that are fit between the employees values and the environmental supplies and the is the balance between the employee capabilities and environmental demands. The outcome of the study reveals that the correlation between the values and supplies as well as abilities and the demand are the strained combined aspects of the Person-Environment Fit approach.

RESEARCH GAP

Based on the review of literature made it was identified that the human behaviour changes as per the various factors such as social, economical, demographic and environmental. The influence of these leads to take the undergone a person into stress, the employee in the organization is unaware that how he or she causing to the stress. The growth of stress leads to create the job tension, job dissatisfaction, inefficiency in the work performance, and losing control on their job, and also it was also identified that the stress is growing in the financial industry especially in the bank, the above said factors are really meant to have betterment in the person as well as the working place. With regard to same it was determined to have a good combination of the Person and Environment. Hence, this study is carried out to see how the Person-Environment Fit approach suits to reduce the occupational stress in the banking industry.

OBJECTIVES OF THE STUDY

1. To know how the Person and Environment fit in the banking sector employees.
2. To study the role of Person-Environment fit approach in reducing the occupational stress.

SCOPE OF THE STUDY

This study conceptually based on the Person-Environment Fit approach as well as the occupational stress. On the basis of these concepts the realizations has been made on the understanding the role of person-environment approach in the banking sector.

In this, both personal factors and environmental factors were considered to know the impact of personal factors on the environmental factors so that it can be understandable the importance of the factors. In the view of the same the personal factors considered are Gender, Age, Educational Qualification, Values, Goals, Emotional Belief, Employee abilities, Personality Type, Self Satisfaction, and the Environmental factors considered such as Job role, Work Pressure, Rewards, Working Conditions, Rules and Regulation, Socialization, Values, Competition and Interpersonal competencies. The opinion on these factors was collected from the 40 employees of the public sector banks and executed the t test to check the impact of the personal factors on the environmental factors.

Data collected from the respondents regarding the impact of the personal factors and environmental factors in reducing the stress.

Personal factors	Yes	No	Environmental factors	Yes	No
Gender	31	09	Job role	31	09
Age	39	01	Work pressure	38	02
Education qualification	30	10	Rewards	27	13
Values	32	08	Working conditions	31	09
Goals	38	02	Rules and regulation	32	08
Emotional belief	38	02	Socialization	30	10
Employee abilities	31	09	Values	29	11
Personality Type	29	11	Competition	31	09
Self Satisfaction	27	13	Interpersonal competencies	27	13

The above table indicates the opinion collected from the 40 bank employees regarding the influence of the Personal factors and Environmental factors on the occupational stress. In the category of the Personal factors the majority of the employees said age, which means that age is the major factor which highly influence on the occupational stress. In the category of the Environmental factors, work pressure is the major factor. In the personal factors the majority of the respondents answered yes for all of the factors and in the environmental factors majority of the respondents opined yes to all of the factors, then it clears that both categories of factors influence the stress level to increase but the stress level can be reduced if there is a good match between the personal factors and the environmental factors, and all required is the compatibility between the personal factors and environmental factors.

It is described generally that the both personal factors as well as the environmental factors have positive correlation, and this leads to have an understanding that there is good compatibility between the personal factors and the environmental factors and it helps in taking work pressure, increase job satisfaction, and eventually reduce the stress level in the employees. If there is incompatibility in the personal factors and the environmental factor, gradually stress level increases. But, at the same time it leads to do an observation that how personal and the environmental factors are important for each other in reducing the occupational stress level. With respect to the same it requires to study the extent of correlation between the personal factors and environmental factors. For the purpose the person correlation is executed, and the results are depicted below.

Correlation		
	Variable 1	Variable 2
Mean	32.77777778	30.66666667
Variance	19.44444444	10.75
Observations	9	9
Pearson Correlation	0.70319631	

It is evidential that there is a good correlation between the personal factors and the environmental factor, hence it leads to have an understanding that there is an association between the personal factors such as gender, age, Education, Values, Goals, Emotional beliefs, Employee abilities, Personality type, self satisfaction with the Job role, Work Place, Rewards, Working Conditions, Rules and Regulations, Socialization, Values, Competition and Interpersonal skills. Hence, it clears that there is a good match between the personal factors and the environmental factors. The compatibility between the people and organizational environment devotes to bring the positive changes in organization, overcome the problem of occupational stress among the bank employees.

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A SYSTEMATIC REVIEW TO STUDY THE BARRIERS LEADING TO GENDER DISPARITY AT TOP LEVEL MANAGEMENT IN CORPORATE SECTOR IN DELHI NCR

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ABSTRACT

The goal of this paper is to summarise and synthesise the available literature on the issues influencing the low representation of women at senior levels in the business sector. This is accomplished by theme analysis of about 20 publications, and the limits of this research have also been used to provide guidance for future research. In India, there are now more working women than ever before, yet the proportion of women in leadership positions is still fairly low. The objective of gender quality, which furthers sustainable development, is violated when women in managerial positions are subjected to gender discrimination. This review paper's analysis of the causes of gender inequality at senior levels in the Indian corporate sector is its main goal. These elements may be societal, individual, corporate, or cultural.

Keywords: Gender Disparity, Inequality, barriers, women employees, top level management

INTRODUCTION

Top managerial roles have a low proportion of women. In the labour market as a whole, and particularly in the senior positions of organisations, gender discrimination is still a problem. Only 13 women, or 2.6% of Fortune Global 500 CEOs, were female in 2020, according to Catalyst [1]. Approximately 37% of managers, 29% of senior managers, and 23% of executives were women, indicating a decline in the proportion of women as management levels rise [2]. A job in top management is easier to come by for males than for women, specifically in Spain [3], which supports the glass ceiling's continued existence. Prejudices in society, particularly the gender barriers in workplaces, are what cause inequality between men and women. Women's rights to equal opportunity and their social freedoms are seriously threatened by gender obstacles. Therefore, research on prejudice against women remains an intriguing topic that calls for multiple viewpoints. In order to achieve social sustainability, businesses must help to combat injustice and advance gender equality. As long as businesses continue to discriminate against women in managerial positions, social sustainability cannot be realised. In this sense, gender equality is one of the Sustainable Development Goals (SDGs), which were included in the 2030 Agenda for Sustainable Development, which was accepted in 2015 by all United Nations Member States. Achieving gender equality and empowering all women and girls is specifically the fifth aim because "ending all discrimination against women and girls is not just a basic human right, it's important for a sustainable future; it's proved that empowering women and girls helps economic growth and development. Additionally, SDG 10 focused on reducing inequality within and between countries, and SDG 8 which refers to decent work and economic growth also includes gender equality. Women are immediately impacted by gender discrimination, but an organisation that targets a certain group of employees will also suffer as a result. Employees who feel treated equally at work may be more emotionally invested in the company and care more about its success than those who see gender discrimination and unfairness there. Work engagement and burnout are significantly predicted by ideas and attitudes about the glass ceiling. Similarly, the perception of gender discrimination among employees is linked to negative work attitudes, physical health outcomes, physical health habits, psychological health, and work-related stress.

In various areas, such as sustainable leadership or education in STEM domains, gender equity has been identified as a critical component for social sustainability. The sustainability challenge would enhance the status of women in management while also enhancing the organization's overall performance. While gender equality at work fosters inclusive and sustainable growth, it also fosters potential economic growth because it can raise employee loyalty to the organisation and boost creativity and productivity. Similar correlations between gender discrimination and organisational outcomes were identified in other studies, as follows: correlations between perceived gender discrimination and organisational identity, affective commitment, and turnover, as well as a positive correlation between perceived gender discrimination and turnover.

The purpose of this essay is to examine the relationships between organisational justice, organisational commitment, and performance and how women's perceptions of hurdles to obtaining managerial roles are perceived. Our work fills a gap in the literature by analysing the moderating influence of gender in the link between organisational justice and dedication and performance in regard to barriers to women's access to managerial roles. More specifically, we examine whether there are gender differences in the performance obstacles that prevent women from being promoted to managerial roles through the mediation of organisational

commitment and beliefs of fairness. Our contribution offers data on how perceptions of organisational employees—both men and women—relate to barriers that prevent women from obtaining managerial roles and how these barriers affect important organisational outcomes. Thus, it appears that equal opportunity for women to hold managerial positions is necessary for social sustainability, but it is also an important factor in achieving sustainable performance. First, we evaluate the prior research on the obstacles to women being promoted, how they relate to perceptions of organisational justice, and how organisational justice and commitment and performance are related. The procedure followed and the outcomes of an empirical study conducted in a financial group to test these relationships are then discussed. A discussion is presented at the end.

OBJECTIVES OF THE STUDY

1. To study different barriers leading to gender disparity at middle and top-level management in Indian Corporate Sector.
2. To explore the ways of minimizing gender disparity at senior level management

S.No.	Author (Year)	Country	Sample Size	Methodology	Factors (Relationship)
1.	Chandra, Shikha	India	-	Review Article	Enablers for self-growth (Communications, Networking, Problem-solving Skills, Multi-tasking, negotiation skills, adaptability & managing change)
2.	Dulacha G. Barako Alistair M. Brown	Kenya	40 kenyan banks	Primary Data: Annual Report of Banks	Dependent Variables: Corporate Social Disclosure Reportings Index. Independent Variables: board composition (independence of board), gender representation on board, foreign nationals on board and non-performing loan ratio, which is a control variable.
3.	Ragins, Belle Rose Townsend, Bickley Mattis, Mary	USA	Fortune 1000 CEOs	Primary Research	Key Career strategies and barriers to advancements
4	Johns, Merida L	USA	-	Secondary Research	Structural, Cultural, Organizational Barriers
5	Shaw et al., (2003)	England	35 national sport organizations employees	Quantitative Study	discourse of masculinity and femininity has led to distinct association between employment roles, gender and these discourses.
6	Seema Jayachandran (June 2020)			Review Article	Cultural barriers
7	Oakley G , 2000			Review Paper	BARRIERS: 1. Corporate Practices 2. Behavioural and Cultural.

8	Amani Moazzam Baig Mirza, Nasira Jabeen (2017)	Pakistan	Questionnaires distributed was 150, 110 completed questionnaires were returned. (Convenient sampling, snowball technique)	Empirical Study	Stereotypes
9	Sarmistha Nandy, Arnab Bhaskar and Sovonjit Ghosh	Review Paper		Review Paper	There are some barriers e.g. psychological barriers, societal-related barriers, organizational barriers against.
10	Ronald J. Burke and Carol A. McKeen (2015)		792 female business graduates (B.Com & MBA)	exploratory study	Gender Proportions, Individual Demographic Characteristics, Organizational & Situational Characteristics, Work Outcomes (Job Involvement, Intent to quit, Job satisfaction, career success, future career progress).
11	Amparo Ramos, et al. (2022)		This study was carried out with 1278 employees (45.2% women and 54.8.% men) of a Spanish financial group consisting of three different organizations	exploratory study	Unequal Performance appraisal, access power networks, work life balance, Unequal HR Practices & policies
12	Quaglieri, Philip L. Pecenka, Joseph O.	San Francisco, USA	Completed promotable woman questionnaires were received from 92 people (65 females and 27 males) for a response rate of 37 per cent. Completed promotable manager questionnaires were received from 68 people	exploratory study	Skill clusters: TOP LEVEL 1. Visioning/ Inspiring 2. Entrepreneurial skill MIDDLE LEVEL 3. People Skills ENTRY LEVEL 4. Implementation skills OTHER SKILLS 5. Specialized Knowledge 6. Perceptual Objectivity

			(36 males, 32 females) for a response rate of 31 per cent. SURVEY		
13	Paul Smith, Peter Caputi and Nadia Crittenden (2012)	Australia	A total of 258 women working in a variety of Australian organizations completed an online questionnaire in the six month period	exploratory study	women’s glass ceiling beliefs (Resilience, Denial, Acceptance, Resignation) and Individual Differences(Age, Education, Marital Status, NUmber of Children, Management Level) are related to: career satisfaction, happiness, psychological/emotional wellbeing, physical health and work engagement (WE).
14	Suparna Jain, Gopa Bhardwaj (2016)	India	300 participants for quantitative data.	exploratory study	perceived diversity climate, work-family conflict and alienation from work.
15	Stamarski, Cailin S Hing, Leanne S Son Elacqua, Tina C (2015)	CANADA		Review Paper	Gender discrimination in HR-related decision-making and in the enactment of HR practices, Gender inequalities in broader organizational structures, processes, and practices. (This includes leadership, structure, strategy, culture, organizational climate, as well as HR policies), organizational decision makers’ levels of sexism
16	Varsha Kumari	India	Pilot study of 30. sample - 100 working women of Rourkela city	exploratory study. Research Article	sexual and mental harassment, promotion issues, family care issues, discrimination based on gender, workplace discrimination and prejudices, safety and security issues etc.
17	Bezbaruah, Supriti Mary, Queen	India	Questionnaire survey of women employees, n=156	exploratory study.	gendered organisational practices, local cultural discourses on femininity, institutional factors, particularly government laws and organisational structures.
18	Mousa, Mohamed Massoud, Hiba K. Ayoubi, Rami M.	Egypt	A total of 260 questionnaires from several public	exploratory study.	Engagement, job satisfaction, affective organizational commitment, workplace happiness, organisational

			hospitals in Egypt were analysed using both t-test and Structural Equation Modelling		citizenship behaviour.
19	Annabi, Hala Lebovitz, Sarah		We conducted a total of 23 semi structured interviews (Spradley, 1979) across 9 cases, which we augmented with documentation	exploratory study.	Barriers (From 23 respondents): Stereotypes, Access & legitimacy/discrimination, Isolation & exclusion, Lack of role models Lack of mentors Lack of network, Men-dominated environment, Poor supervisory relationship, Uncertainty about career role and career, Women not supporting women, Lack of sponsors, IT work-life conflict, Work-life balance, Nature of IT, Fear of perceptions, Difficult to participate in interventions
20	Warmington, Joy	India		Review Article	FACTORS- gender bias, motherhood penalty, lack of female role models, govt. specific factors (low women since 70s, relocations in psb, hiring practices)
21	Desimone, Kimberly	America	semi-structured phone interviews with 13 women in an organization in the S&P 500, who have been identified by organizational leadership as having high advancement potential	exploratory study.	Push variables: External, social, organizational variables related with pushing women out of workforce. Pull variables: internal, personal, that pull women away from attaining their professional potentials like delaying promotion, motherhood, WLB, lack of desire for power.
22	Ramya, K R Raghurama, A	India		Review Paper	burden of the dual role, sexual harassment in the workplace, the refusal of men to accept women bosses, and the lack of solidarity among women, dual responsibility. promotions linked with transfers; difficulties in

					working late; or because women shy away from responsibility, having a low opinion of their own abilities and a negative attitude to accepting recognition. stereotypes, assumptions and biases about what is required for leadership and success, lack of infrastructural facilities, the transfer policy, and assumptions that women would not be interested in training or in promotions
23	Egan, Andy	India		exploratory study.	Terms & Conditions of employment, recruitment, training, promotion, career progression & management development, domestic responsibilities like maternity & childcare or part-time employment or late or re-entry, New technology,
24	Bertrand, Marianne Goldin, Claudia Katz, Lawrence F.	USA	2485 (1856 men, 629 women) MBAs from University of Chicago	exploratory study.	We identify three proximate reasons for the large and rising gender gap in earnings that emerges within a few years of MBA completion: differences in business school courses and grades; differences in presence of children and career interruptions; and differences in weekly hours worked.

LITERATURE REVIEW

(Ragins et al., 1998) The Fortune 1000 CEOs had vastly different perceptions of the organizational and environmental barriers faced by their female employees, and in their companies' progress towards equality in the workplace ranging from Key Career strategies and barriers to advancements.

(Oakley G, 2000) considers a variety of factors, such as a lack of line experience, poor career possibilities, gender disparities in linguistic and socialisation patterns, gender-based stereotypes, the old boy network at the top, and tokenism, to explain why women have not achieved the top positions.

It primarily covered two barriers

1. Corporate policies (lack of training in areas like operations, manufacturing, marketing, etc., the prevalence of women in staff support fields like HR & PR, the absence of women-friendly promoting procedures, and the pay disparity between men and women.)
2. Behavioural and cultural factors (gender differences, double standards, and communication styles; women are less forceful, less self-promotional, and do not exaggerate their accomplishments than males). Gender-based stereotypes: Men are associated with being aggressive, independent, unfeeling, energetic, and logical, whereas women are associated with being emotional, less self-assured, less analytical, and less consistent. Inversely, handsome guys and unattractive females are preferred and regarded as more capable. Women are less drawn to positions of authority since it is generally believed that men are better suited for them. Women in positions of authority claim that men are uncomfortable in their presence. Top-level women are viewed as a danger to the old boy network. The brightest female talent is driven away by tokenism at the top.

(Shaw & Hoerber, 2003) studied the development and reinforcement of discourses on masculinity and femininity, as well as how these discourses altered job roles within three English national governing bodies of sport. Male-dominated discourses were linked to powerful coaching and senior management posts, while female-dominated discourses were linked to less powerful RDO and teaching responsibilities. Accepting this discourse on gender and femininity has resulted in clear distinctions between job positions. Women were somewhat able to associate with work responsibilities that were impacted by discourses of masculinity in all three firms, demonstrating that women are capable of filling senior management roles. Despite an increase in female senior sport management jobs over the past 30 years, men still hold most of these positions, highlighting a level of gender inequality in sport management.

(Johns, 2013) Gender stereotypes and gender communication differences pose dilemmas for women. Gender typecasts create a double bind in which women can be penalized for displaying either too little or too much assertiveness, competitiveness, and independence.

(Chandra, 2014) The purpose of this paper is to understand the global & local dynamics pertaining to under-representation of women in boardrooms. When it comes to women representation in boards, global figures fare better as compared to the Indian numbers. It also indicates that giving a favourable environment, that includes some initiatives from the government, the organizations, and the individual, will surely pave the way for women development. This study aims at providing suggestions to the Government, Organizations, and Individuals to adopt certain measures in order to reduce gender disparity.

(BARRIOS, 2014) This exploratory study investigated several topics, including workplace prejudice and discrimination, family care challenges, sexual and mental harassment, promotion issues, and safety and security concerns. Background information included things like age, education level, marital status, occupation, years of experience, type of organisation, etc.

(Nandy et al., 2014) This study discussed a variety of hurdles, including organisational, societal, and psychological ones. Women still encounter obstacles to career progression, gender stereotypes, and other dangers from both inside and outside the business. Even within organisations, their positions are predetermined, they do not participate in decision-making processes or form informal groups or networks. Women get disinterested as a result, and many times they leave their jobs and never return. Men are expected to have male features in managerial positions, but when women do, they are rejected because they are not displaying feminine attributes.

(Do Women at Top Make a Difference? Gender Proportions and the Experiences of Managerial and Professional Women., 2015) This exploratory study looked at how the gender ratios in the organisations they work for affected the satisfaction and work experiences of management and professional women. Women in management and professional positions who worked in organisations that were skewed or titled—with the majority of men in senior management and at all levels—were less satisfied with their jobs and expressed more intention to leave than women who worked in organisations with fewer men in positions of corporate management. The study leaves room for more research into the causes of these findings, which may include women's exclusion from the old boys' network in firms with a male preponderance, possible senior men's insensitivity to women, a lack of female mentors and role models, etc. Gender proportions, individual demographic characteristics, organisational and situational characteristics, and work outcomes (job involvement, intent to stay on the job, etc.) were considered in this study.

(Stamarski et al., 2015) Factors like gender inequality in larger organisational structures, processes, and practises, as well as gender discrimination in HR-related decision-making and in the implementation of HR practises, were taken into account. Organizational decision-makers' levels of sexism (this encompasses leadership, structure, strategy, culture, organisational climate, as well as HR rules).

(Moazzam, 2017) The selection criteria for women in management were negatively impacted by stereotypes and positively impacted by education. Although the criteria stay the same as we move up the hierarchy, bias against women occasionally surfaces in the form of cultural and societal standards, as indicated by a small number of female respondents when applying for higher managerial positions. Women in management and their professional growth would benefit from a good culture, and vice versa. In order for women to advance in their careers, the society must take a supportive stance toward them.

It has also been noted that it might be challenging for women to build authority and credibility with their subordinates, particularly with organisational line managers who believe that only men should hold senior positions in the organisation. Additionally, it is clear from the data that more women than men have been hired on a contract basis. They would describe a woman who is their boss and outspoken as hostile and haughty.

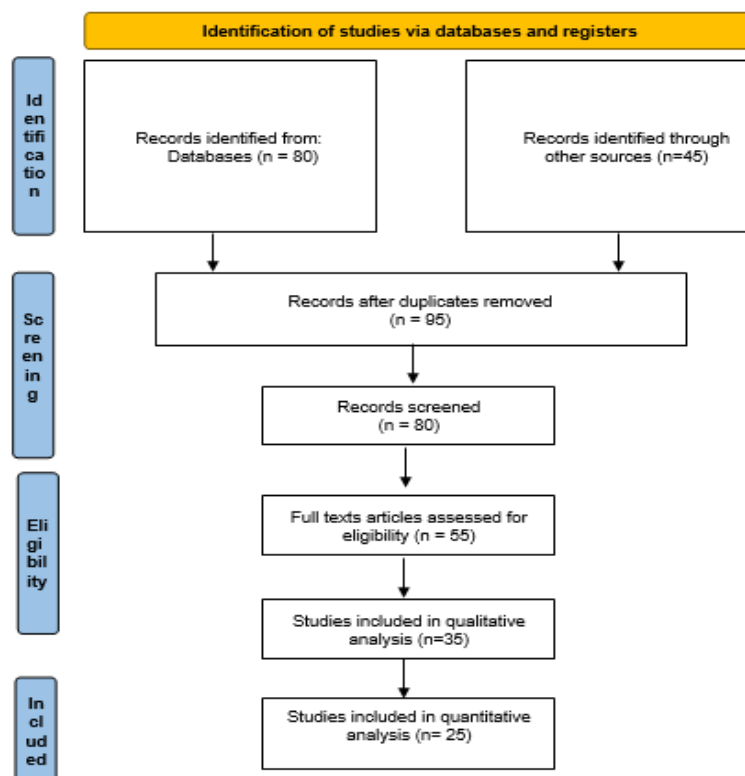
When asked why women were unable to advance to the highest executive positions, every respondent stated that cultural pressures were to blame. Some ladies claimed that they were responsible for the violence.

(Jayachandran, 2020) outlined the ways in which gender norms prevent women from participating fully and equally in the job sector in developing nations. Cultural barriers such as violence and harassment against women in public places, limitations on women's social interactions and freedom of movement, control over household finances, violence in intimate relationships, who should be the breadwinner, who is responsible for household duties and childcare, and ways to change social norms were among the obstacles.

(Ramos et al., 2022) This study was conducted with 1278 employees (45.2% women and 54.8%) of a Spanish financial group made up of three different organisations with the goal of examining how gender influences the relationship between performance and gender barriers to managerial positions, which is mediated by organisational justice and commitment, as well as whether this relationship is stronger in women as compared to men. According to the findings, some gender obstacles are linked to lowered views of organisational justice, which are linked to less organisational commitment, which lowers performance. Additionally, this association is significant in both men and women for barriers to accessing powerful networks and work-family balance, while it is only significant in women for unfair HR policies and practises. From a gender perspective, the objective that will support organisational sustainability is the elimination of gender obstacles and unfairness perceptions.

RESEARCH METHODOLOGY

The research article conducts a review study, looking at the numerous factors that contribute to the gender disparity at the top of the corporate sector. The objective is to conduct a thorough examination of the types of barriers that contribute to the low representation of women in top-level management. A total of 20 publications that were downloaded from Scopus and UGC were vetted, evaluated, and ultimately compared to discover any commonalities. Thematic analysis of these 20 research papers was used in the research methodology to determine the interplay of the elements that prevent women from rising to the top.



DISCUSSION & CONCLUSION

The recruiting, training, salary, and promotion of women to the highest levels of a business are all impacted by the complicated phenomena known as gender disparity. Along with organisational aspects, social variables are also taken into consideration. Women constantly balance a variety of challenges, such as pressures from society and their families, different responsibilities played by women, child care, and work-life balance. It's interesting to note that these elements exist not only in India but even abroad. Another hurdle to women moving up the corporate ladder is the stereotyping of gender roles, positions, and characteristics. Male managers hold more preconceived notions about women managers than female managers, and they seem to think these preconceived notions have a bigger impact on their capacity to advance.

However, similar preconceptions also apply to female managers. When it comes to female co-workers and superiors, men are uncomfortable. They oppose the normalisation of older women and frequently forbid women from joining the boy's club or network. This is another factor in the lack of acceptance of women. It has been noted that women must put in more effort than males to achieve parity in pay or advancement. Despite both sexes working hard, men and women have different performance rating methods and criteria. This is something that seriously deters women from working to advance themselves. Women experience discrimination both at work and in the home. Their self-perceived norms can, however, occasionally prevent them from succeeding.

It is crucial that HR policies and guidelines acknowledge these obstacles and begin developing more gender-inclusive rules. We suggest that gender inequality in broader organisational structures, processes, and practices—including HR policy but also leadership, structure, strategy, culture, and organisational climate—is the root cause of gender discrimination in HR-related decision-making and the implementation of HR practises. In order to support female employment, policies and initiatives that are created to circumvent these standards should be put into place. It's crucial to understand that pursuing equity over equality is the better course to take.

Although changing cultural norms won't be simple, it can be done gradually with the help of willing men. Some ways to lower these barriers and achieve gender parity at work include equalising the distribution of household chores among family members, family support, the availability of childcare facilities at work, flexible work schedules for women, and giving women a fair chance when they are ready to return from a sabbatical. Future sustainable development can only occur in this way.

There is a need to take some measures in order to reduce the gender disparity in the Indian Corporate Culture. The measures can be organizational, government, cultural and personal. The organizations should introduce such HR laws that support women and promote equity in the work culture.

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MICROBIAL PRODUCTION OF BIOPOLYMER: A REVIEW

Punniavan Sakthiselvan, S. S Meenambiga, P. Vivek, H. Sowmya and S. Ivo RomauldDepartment of Bioengineering, Vels Institute of Science Technology and Advanced Studies (VISTAS),
Pallavaram, Chennai – 600117**ABSTRACT**

Biopolymers are naturally occurring materials: most materials formed in nature during the life cycles of green plants, animals, bacteria and fungi are polymers or polymer matrix composites. For example, all proteins are specific copolymers with regular arrangements of different types of α -amino acids. This natural synthesis is an extremely complex process involving many different types of enzymes and is not as yet practical as a complete production route for commodity polymers. Polyhydroxyalkanoates (PHA) has rich properties depending on the structures. Homopolymers, random copolymers, and block copolymers of PHA can be produced depending on the bacterial species and growth conditions. With over 150 different PHA monomers being reported, PHA with flexible thermal and mechanical properties has been developed. Such diversity has allowed the development of various applications.

Keywords: Biopolymer, Microorganism, Polyhydroxyalkanoates, Polyhydroxybutyrate, Degradation.

1. MICROORGANISMS THAT PRODUCE PHA

In recent years, sustainability, environmental concerns and green chemistry have played a big role in guiding the development of the next generation of materials, products and processes. The persistence of plastics in the environment, dwindling petroleum resources, shortage of landfill space and the concerns over emissions of toxic gases during incineration have fuelled efforts to develop biodegradable polymers from renewable resources. Particularly, renewable agricultural and biomass feedstock have shown much promise for use in eco-efficient packaging to replace petroleum feedstock without competing with food crops.

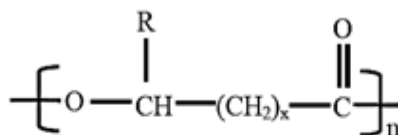
Polyhydroxyalkanoates (PHAs) is natural and linear polyesteric biological macromolecules that can be produced by several microorganisms in the form of intracellular carbon and energy storage granules in response to excess carbon substrate and limited quantities of nitrogen source in growth environment. They are also completely degraded into carbon dioxide and water by the depolymerises present in the microorganisms¹. Polyhydroxybutyrate (PHB) was the first type of PHAs discovered and the most widely studied. PHB share many material properties similar to synthetic polymers, along with exclusive properties such as biodegradable, biocompatible and can be obtained from renewable sources, but its production costs are higher than the petroleum derived plastics^{2,3}.

A wide variety of bacterial species are known to accumulate PHA⁴. PHA has been reported from various environments such as soil, sewage sludge, marine sediments, ponds, mangrove environments⁵ and Gas field soil⁶. Microorganisms that produce PHA are discussed with respect to two aspects viz. microbiological and basic genetic makeup of the organism and the economic aspects for PHA production⁷. Many microorganisms are known to store PHA as their intracellular storage of energy.

2. POLYHYDROXYALKANOATES

Polyhydroxyalkanoates (PHA), a family of biopolyesters with diverse structures, are the only bioplastics completely synthesized by microorganisms. PHA can be synthesized by over 30% of soil-inhabiting bacteria⁸. Many bacteria in activated sludge, in high seas, and in extreme environments are also capable of making PHA. In the last 10 years, PHA has been developed rapidly to find applications in various fields.

In nature, prokaryotic microorganisms respond to sudden increases in essential nutrients in their usually hostile environment by storing important nutrients for survival during prolonged period of starvation. PHAs are one such storage compound. PHAs are usually produced when carbon sources are in excess. The carbon sources are assimilated, converted into hydroxyalkanoate (HA) compounds and finally polymerized into high molecular weight PHAs and stored as water insoluble granules in the cell cytoplasm. PHAs are an excellent storage compound because their presence in the cytoplasm, even in large quantities does not disturb the osmotic pressure of the cell.



		Type of monomer
x = 1	R = methyl	3-hydroxybutyrate; 3HB
	R = ethyl	3-hydroxyvalerate; 3HV
	R = propyl	3-hydroxyhexanoate; 3HHx
x = 2	R = hydrogen	4-hydroxybutyrate; 4HB
x = 3	R = hydrogen	5-hydroxyvalerate; 5HV

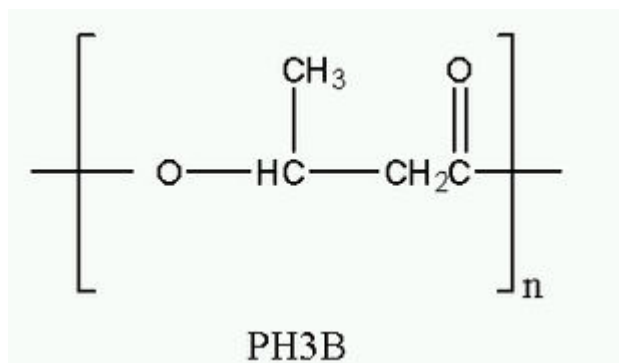
FIG 1: General Structure of PHAs

PHAs are polymers of carbon, oxygen and hydrogen and the general structure of the polymer is shown in Fig 1. R refers to the length of the side chain whereas x refers to the size of the alkyl group. Both R and x determines the type of HA monomer unit. When the total number of carbon atoms in the HA monomer unit is equal to or less than five, the HA is known as a short chain-length (SCL) monomer and the PHAs resulting from the polymerization of SCL monomers are known as SCL PHA. When the total number of carbon atoms in the HA monomer unit is at least six and up to 14, the HA is known as a medium chain-length (MCL) monomer and the PHAs resulting from the polymerization of MCL monomers are known as MCL PHA.

3. POLY-3-HYDROXYBUTYRATE

P(3HB) is the first member of PHAs to be discovered in microorganisms Fig 2. The role of P(3HB) as an energy source during nutrient-depletion for enhancing the survival of bacteria is well accepted. Subsequently, interest in the metabolic pathways and regulatory mechanisms of P(3HB) biosynthesis in bacteria has led to the establishment of P(3HB) metabolism in *W. eutropha*. P(3HB) biosynthesis is a three-step process and is regulated by 3-ketothiolase, acetoacetyl-CoA reductase and the SCL PHA synthase

Today, it is known that P[3HB] is the most common PHA found in nature. Based on the MW of the biosynthesized P[3HB], they can be divided into three distinct groups, i.e., low MW P[3HB], high MW P[3HB], and ultra-high molecular weight (UHMW) P[3HB].



n = 120-200: Low molecular weight P[3HB]

n = 1,000-20,000: High molecular weight P[3HB]

n = 100,000: Ultrahigh molecular weight P[3HB]

FIG 2: Chemical structure of poly [R-3-hydroxy butyrate] (P[3HB])

The low MW P[3HB] which is also known as complexed P[3HB] (cP[3HB]) is an ubiquitous cell constituent that exists in Eubacteria, archaebacteria, and eukaryotes. Recent studies have also revealed the presence of cP[3HB] in humans. This cP[3HB] consists of about 120-200 3HB units and have a MW of about 12,000 Da. Depending on the strength of their association with macromolecules, chloroform-soluble and chloroform-insoluble cP[3HB] have been identified. The former forms a weakly bound (non-covalent) complex with polyphosphate salts while the latter is usually strongly bound (covalent) complex with proteins. These complexes are thought to function as ion (Ca²⁺) transport channels across cell membranes and also may facilitate the uptake of extra cellular deoxyribonucleic acid (DNA) material. Polyhydroxybutyrate (PHB), a biodegradable polymer (an intracellular product) was produced using *Bacillus safensis* EBT1⁹.

4. BIOSYNTHESIS OF POLY-3-HYDROXYBUTYRATE

P(3HB) biosynthesis pathway was the first to be deciphered paving way to understand the nature's role which subsequently led to discovery of other PHA biosynthesis pathways. The P(3HB) biosynthesis, otherwise called as the three-step biosynthesis pathway, mainly consists of three enzymatic reactions catalyzed by three distinct enzymes shown in Fig 3. The enzymes are β -ketothiolase, acetoacetyl-CoA reductase and PHA synthase.

4.1 β -ketothiolase

β -ketothiolase catalyzes the first step in P(3HB) formation. It is a member of the family of enzymes involved in the thiolytic cleavage of substrate into acyl-CoA and acetyl-CoA. This is the most thermodynamically favored reaction. But under the availability of reducing equivalents in the form of NADPH, it acts against the thermodynamically favored direction and aids in the P(3HB) biosynthesis. These are found throughout nature from higher eukaryotes to yeasts to prokaryotes and are found to be in soluble form in vivo.

4.2 Acetoacetyl-CoA reductase

This is a (R)-3-hydroxyacyl-CoA dehydrogenase. Like ketothiolase, it is also a soluble protein. It catalyzes second step in the P(3HB) biosynthetic pathway by stereo-selective reduction of acetoacetyl-CoA formed by β -ketothiolase to 3-hydroxybutyryl-CoA. Two types of reductases are found in organisms. First type is a NADH dependant reductase, while the second type is a NADPH dependant. The former is a tetramer with identical subunits of 30 kDa and plays role in the β -oxidation of fatty-acids, and in association with thiolase participates in the conversion of butyrate, crotonate and β -HB to acetyl-CoA. The latter is a homo-tetramer of 25 kDa subunits and participates in the biosynthesis of P(3HB) by reduction of acetoacetyl-CoA to 3-HBCoA.

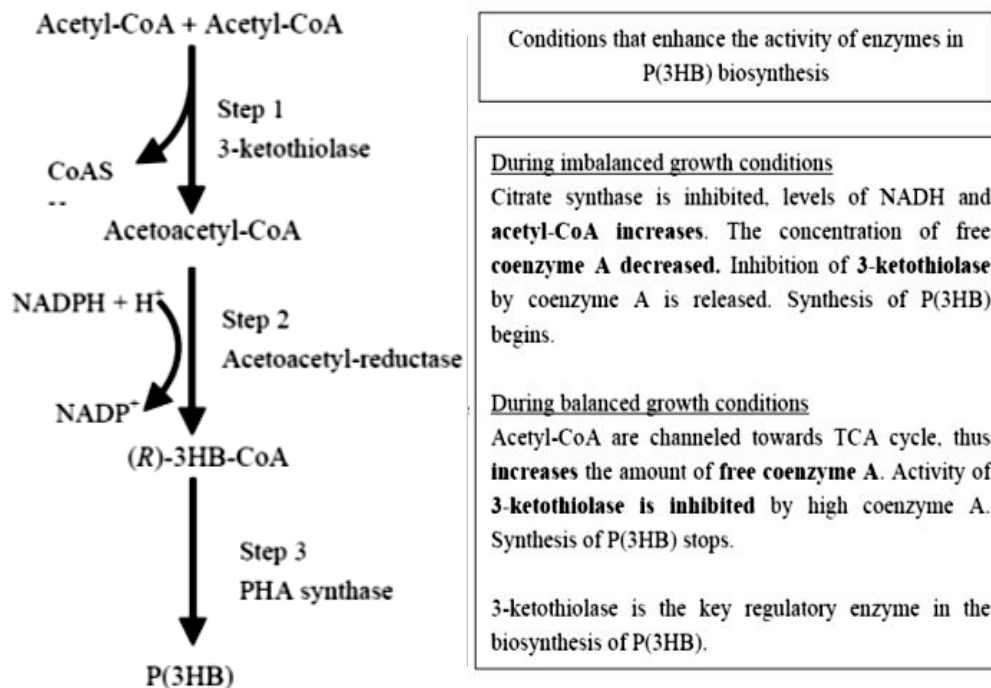


FIG 3: Metabolic pathway involved in the synthesis of P(3HB)

4.3 P(3HB) synthase

The last reaction in the polymer formation is catalyzed by the enzyme PHB synthase which links D(-)- β -hydroxybutyryl moiety to an existing polyester molecule by an ester bond. This key enzyme determines the type of PHA synthesized. PHB synthase is soluble only as long as no PHB synthesis and accumulation occurs in an organism. It, however, becomes granule associated under storage conditions. Three different types of PHA synthases have been identified based on their primary structure and substrate specificities. With respect to size and structure, type I and type II are distinguished from type III synthases. While type I and type II synthases are homodimeric, type III synthases are heterodimers¹⁰.

5. REGULATION OF PHB BIOSYNTHESIS

Although various aspects of PHA production have been studied extensively, knowledge of the regulatory mechanism at the molecular level is relatively limited. Regulation of PHA metabolism can take place at different levels:

- activation of pha gene expression due to specific environmental signals, such as nutrient stress etc.,

- activation of the PHA synthase enzymes by specific cell components or metabolic intermediates,
- inhibition of metabolic enzymes of competing pathways and therefore enrichment of required intermediates for PHA synthesis and
- a combination of these.

6. Biodegradation

Biodegradation is a process by which microbial organisms (mainly bacteria and fungi) transform or alter (through metabolic or enzymatic action) the structure of chemicals introduced into the environment.

Perhaps one of the greatest advantages that PHAs possess over other biodegradable polymers is their ability to degrade under both aerobic and anaerobic conditions. They can also be degraded by thermal means or by enzymatic hydrolysis¹¹. In a biological system, PHAs can be degraded using microbial depolymerases as well as by nonenzymatic and enzymatic hydrolysis in animal tissues. The biodegradability of a polymer is governed primarily by its physical and chemical properties. It has been found that low molecular weight PHAs are more susceptible to biodegradation^{12,13}. The melting temperature is another important factor to be considered when studying biodegradation. The melting point increases, the biodegradability decreases. With increasing melting temperature, the enzymatic degradability decreases. Lipases cannot hydrolyse the optically active P(3HB). This could be due to the high melting temperature of the latter (178 °C). Mochizuki and Hiramami explained that biodegradation of solid polymers is influenced by chemical structure (especially functional groups and hydrophilicity– hydrophobicity balance) and highly ordered structures (mainly crystallinity, orientation and morphological properties). Reaffirmed the crystallinity plays a very important role in biodegradability. They also identified that highly ordered structures, i.e. highly crystalline materials have lower biodegradability. In addition, the microbial population in a given environment and the temperature also contribute to biodegradability in the environment^{14,15}.

Degradation of polymer in marine environment

As formerly accomplished, once plastic wastes enter the marine environment, the large particles of plastic are first fragmented to form microplastics or nanoplastic particles. This multistage process is influenced by a variety of biotic and abiotic factors^{16,17}. It means that microbial attachment on the surface and formation of biofilms depend not only on microorganisms' abilities but also on the properties of the material and the surface structure¹⁸ such as the surface roughness, topography, surface free energy, surface electrostatic interactions, and surface hydrophobicity¹⁹. Additionally, various factors related to environmental conditions such as salinity, temperature, oxygen level, and limitation of light have an impact on biofilm development^{20,21}. Particularly, the increase in degradation rate by raising the temperature and humidity may be crucial. Different variations in sea temperature are expected to affect the rate of plastic degradation due to acceleration or inhibition of chemical reactions²². Hence, the biomass of a fouling community influenced by different surface characteristics and environmental conditions. It was suggested that bacterial adhesion to the plastic surface depends on the physicochemical surface and bacterial properties rather than on biological processes. At the same time, biotic and abiotic factors have an influence on released products²³.

Application of biopolymers

PHA has rich properties depending on the structures. Homopolymers, random copolymers, and block copolymers of PHA can be produced depending on the bacterial species and growth conditions. Biodegradable polymers have focussed on three major areas

- Medical
- Agricultural
- Packaging

Biodegradable plastics have been developed as surgical implants and as drug delivery agents for controlled and long-term release of drugs to targeted sites. These biomaterials are also being used as absorbable surgical sutures, for use in the eye, bone fixation devices, vascular grafts, and artificial skin .

Biopolymers are also used in controlled release of pesticides, nutrients, agricultural mulches and planting containers. Most of the biopolymers are developed into packaging materials especially as food packaging materials. Biodegradable plastic packaging is slowly being adopted by food service companies for use as films for sandwich wraps or for packaging fresh products such as salads, pasta or bakery goods²⁴.

PHB as Packaging Materials

PHB was initially used to make everyday articles such as shampoo bottles and packaging materials. PHB were also developed as packaging films mainly for uses as shopping bags, containers and paper coatings, disposable items such as razors, utensils, diapers, feminine hygiene products, cosmetic containers, and cups as well as medical surgical garments, upholstery, carpet, packaging, compostable bags and lids, or tubs for thermoformed articles

PHB as Biomedical Implant Materials

Only several PHA, including PHB, PHBV, P4HB, PHBHHx, and PHO, are available in sufficient quantities for application research. This is why most of the application research, including tissue engineering and controlled drug release, is based on the above-mentioned PHB.

PHB and its composites have been used to develop devices including sutures, suture fasteners, meniscus repair devices, rivets, tacks, staples, screws (including interference screws), bone plates and bone plating systems, surgical mesh, repair patches, slings, cardiovascular patches, orthopedic pins (including bone filling augmentation material), adhesion barriers, stents, guided tissue repair/regeneration devices, articular cartilage repair devices, nerve guides tendon repair devices, atrial septal defect repair devices, pericardial patches, bulking and filling agents, vein valves, bone marrow scaffolds, meniscus regeneration devices, ligament and tendon grafts, ocular cell implants, spinal fusion cages, skin substitutes, dural substitutes, bone graft substitutes, bone dowels, wound dressings, and hemostats.

PHB as Drug Delivery Carriers

Homopolymers and copolymers of lactate and glycolate are widely used in commercially available sustained release products for drug delivery. However, lactate and glycolate copolymers are degraded by bulk hydrolysis; hence, drug release cannot be fully controlled. In the early 1990s, PHB became candidates for use as drug carriers owing to their biodegradability, biocompatibility, and degradation by surface erosion.

PHB as Biofuels

3-hydroxybutyrate methyl ester (3HBME) and methyl 3-hydroxyalkanoate methyl ester (3HAME) obtained from esterification of PHB and methyl PHB could be used as biofuels.

PHB Monomers as Drugs

Sodium salts of D-3-hydroxybutyrate (D-3HB), DL-3-hydroxybutyrate (DL-3HB), and 3HBME are derivatives of 3HB, a body ketone that is produced in vivo in animals, including human. D-3HB is the most common degradation product of microbial PHB that have been investigated for tissue engineering applications. 3HB and its derivatives (collectively called 3HB derivatives) were reported to have an effect on cell apoptosis and the cytosolic Ca²⁺ concentration of mouse glial cells.

Learning and memory require energy-demanding cellular processes and can be enhanced when the brain is supplemented with metabolic substrates. It was found that neuroglial cell metabolic activity was significantly elevated when neuroglial cells were cultured in the presence of the PHB degradation product 3HB and derivatives.

PHB Nanoparticles

Nanoparticles can be developed from a variety of materials such as synthetic polymers, proteins and polysaccharides. Biopolymeric nanomaterials are advantageous compared to the synthetic polymers, as they are biodegradable, biocompatible and non-toxic in nature. Biopolymeric nanoparticles hold enormous applications as vehicle for administration of drugs and vaccines. Bioactive molecules within the nanoparticles can target specific sites (tumors) and deliver at those desired locations.

Nanoparticles used for anticancer drug delivery can be made from a variety of materials, including polymers, dendrimers, liposomes, and metals such as iron oxide. Polyhydroxyalkanoates (PHAs) are linear biodegradable polymers synthesized by bacteria. PHAs can be produced by many different bacterial strains. They are naturally synthesized by bacteria as a storage molecule in response to conditions of physiological stress. There are many types of PHAs such as PHB (Poly-3-hydroxybutyrate), PHV (Poly-3-hydroxyvalerate), and PHHx (Poly-3-hydroxyhexanoate). Among them PHB is the most widely used member of this group. There are many properties of PHB that enable us to use them in drug delivery systems. First, PHB is biodegradable and it is known that they can be degraded by PHA hydrolases and PHA depolymerases. Second, PHB are biocompatible and no toxic effect is observed during in vivo applications²⁵.

CONCLUSION

Plastic is considered to be an individual gift of modern science and technology to mankind. This unique wonder material has some mutually exclusive qualities of being very light, yet strong and economical. The mammoth scale of the use of plastics and their disposal has threatened natural environment. Nowadays, plastics and synthetic polymers are mainly produced from petro chemical elements, which do not decompose, thus resulting in the environmental pollution. They are stored, burnt and recycled. During combustion, water and carbon dioxide are released into the atmosphere. In household waste, 30 percent are plastic- packaging foil, like food bags or coated foil on paper. The reorganization of environmental pollution problem caused by synthetic plastics has led to the search of alternative materials-the biodegradable plastics. Biodegradable plastics of renewable resources origin also help to preserve the non-renewable resources and contribute to sustainable development. In recent years, there has been an increasing trend towards more efficient utilization of relatively cheaper substrates for PHB biosynthesis (via) formation. Finding a less expensive substrate is, therefore, a major need for a wide commercialization of PHB. Production processes based on waste carbon sources are the requirement of the day, instead of hobbler one. In biotechnological aspects, cheap substrate and genetically modified high PHB yielding bacteria or plants can be used in this biopolymer production technique. Several factors influence the economics of biodegradable polymer production.

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VACCINATION: AN APPROACH TO END PANDEMIC

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Chennai, Tamil Nadu**ABSTRACT**

Viral infection stimulates the host immune system which is initiated by the activation of innate immune cells that recognizes the molecular patterns associated with the pathogens. Failure of the innate immune responses in eliminating the virus leads to the activation of adaptive immune system. Induction of innate and adaptive immune cells stimulate the secretion of cytokines or chemokines like interleukin-6 (IL-6), interferon- γ (IFN- γ), interferon- γ -inducible protein-10 (IP-10) and monocyte chemoattractant protein-1 (MCP)-1. These cytokines and chemokines promote the influx of monocytes/macrophages and neutrophils from the blood to the site of infection. These cells secrete the cytotoxic substances to clear the viral infection. In case of SARS-CoV-2 infection intense inflammatory response against the virus leads to excessive production of pro-inflammatory cytokines which thereby promote lung pathogenesis and respiratory failure. Covishield comprises the larger proportion in the vaccination program in India. Hence, it is of utmost importance to understand neutralizing capability of vaccine against the B.1.617.1 variant which is considered to responsible for surge of the cases in India. Covishield vaccine-induced antibodies are likely to be protective to limit the severity and mortality of the disease in the vaccinated individuals. The reason for giving the vaccine through intramuscular injection is that the muscle cells consist of more immune cells and recognize the antigen introduced by vaccine that stimulates an immune response.

INTRODUCTION

Viral infection stimulates the host immune system which is initiated by the activation of innate immune cells that recognizes the molecular patterns associated with the pathogens. Failure of the innate immune responses in eliminating the virus leads to the activation of adaptive immune system.1 Vaccination is an effective way to prevent viral infection, stop its transmission, and develop herd immunity. Rapid progress and advances have been made to date in the development of COVID-19 vaccines. Induction of innate and adaptive immune cells. stimulate the secretion of cytokines or chemokines like interleukin-6 (IL-6), interferon- γ (IFN- γ), interferon-inducible protein-10 (IP-10) and monocyte chemoattractant protein-1 (MCP)-1. These cytokines and chemokines promote the influx of monocytes/macrophages and neutrophils from the blood to the site of infection. These cells secrete the cytotoxic substances to clear the viral infection.2 The discovery of a vaccine against the novel coronavirus is an important component of the three-pronged approach described initially, given that the pandemic cannot seem to be entirely stopped by social distancing and good hygiene practices [3]. Vaccines are the substance used to activate the immune response of a person by evoking the production of antibodies. There are different techniques for the synthesis of COVID vaccines. The vaccine mainly aims at antiviral strategies involving small molecule and biological targeting complex molecular interaction involved in coronavirus infection. The need to rapidly develop a vaccine against SARS-COV2 comes at a the time of explosion in basic scientific understanding including in areas such as genomics and structural biology that is supporting a new area in vaccine development [4].

Immunity and Vaccination

Understanding the types of immunity is important to understand about vaccination. As soon as the virus enters the lung, the host immune response is activated. The innate immunity plays the first line of defense in the virus clearing, which is brought about by macrophages. This initiates the adaptive immunity through cytokines and chemokines secretions which involves T-cell and B-cell response. The CD4 T-cells are responsible for an antibody response which the CD8 T-cells kill the virus infected cells directly [5]. If the person comes in contact with the native pathogen, the immune system will already have the necessary antibodies ready and will multiply them much faster because it has already been sensitized by vaccination. During vaccine development, there are a few considerations, such as its safety and efficacy, which need to be identified as well as quantified. There have been two known syndromes associated with post vaccine administration. First is antibody-dependent enhancement (ADE) and second is vaccine-associated enhanced 44 Vantage: Journal of Thematic Analysis, 2021; 2(1): 42-66 respiratory disease (VAERD). In ADE, the binding of virus-antibody complex to Fc- (tail region of antibody)-receptor shows high efficiency [6]. The vaccines against a virus can be of different types depending upon the technological platforms used to synthesize them. These may include inactivated or live attenuated viral particles, virus-like particles not containing viral genome, recombinant viral proteins or peptides, viral nucleic acids encapsulated in delivery vesicles like liposomes or inserted in plasmid vector, and

viral vectors which may or may not replicate in host cells [7]. In one of the initial human trials, a COVID-19 vaccine was developed using an adenovirus type 5 (common cold virus) vector containing partial genetic material of Coronavirus that encodes the spike protein. Just one dose of this vaccine, named Ad5-nCoV, found to generate specific T-cells and antibodies against the Coronavirus and was also found safe [7]. New manufacturing platforms, structure-based antigen design, computational biology, protein engineering, and gene synthesis have provided the tools to now make vaccines with speed and precision [8]. The design of vaccine includes the choice of antigen, vaccine platform, and vaccination route and scheme.

For SARS-COV, it has been shown that only antibodies against S protein can neutralize the virus and prevent infection (3). Therefore, all SARS-COV-2 vaccines under development contain at least part of the S protein.[9]. The rapid increase in morbidity and mortality of the COVID-19 pandemic has led to a drastic shift in the conventional vaccine development paradigm and timelines from a time frame of 10–15 years to 1–2 years. In an ideal world, a vaccine should have high efficacy, with minimum adverse reactions. It should stimulate both humoral and cell-mediated immune responses while being able to induce life-long immunity in the recipients[11].

CLASSES OF VACCINES

1. Inactivated Viral Vaccines

In an inactivated viral vaccine, the target virus has lost the ability to replicate and, thus, it is safe for use in a vaccine to trigger an immune response [41]. Inactivated vaccines predominantly trigger humoral responses that release neutralizing antibodies [42]. The inactivated viruses cannot penetrate the host cells actively; they can only rely on endocytosis to be taken up into the cells. If they are phagocytosed by dendritic cells, cross-presentation of peptides can only activate a limited number of cytotoxic T cells. Inactivated viral vaccines exhibit lesser immunogenicity and have a shorter duration of protection than live vaccines [11]. These vaccines are able to mount a weak immune response, particularly, humoral immune response, leading to reduced antibody titer. Therefore, such vaccines can be administered with adjuvant in order to increase the immunogenicity and often require repeated boosters to maintain the immunity [12].

2. Live-Attenuated Vaccines

It is based on the production of attenuated strain of actual pathogens by in-vitro passaging resulting in limited replication potential of the pathogen which has lost the ability to cause the disease in the host. Also, attenuated strains can be designed by either deleting or mutating the virulence genes in the pathogen. In this line, deletion of virulence factors for generating attenuated strain of SARS-CoV-2 was considered for the development of its vaccine.

3. Viral Vector-Based Vaccine

Viral vector-based platforms utilize bioengineered viral backbone of either replicationdeficient or attenuated replication. Such vaccines are known to be highly specific and efficient in eliciting a strong immune response. few viral vectors, including adeno-associated virus, give low titre production and thus may not be cost effective. In spite of such disadvantages, viral vectors are considered to be the most common platform in vaccine development [13].

4. Protein Subunit Vaccines

Subunit vaccines can be designed to focus the immune response towards neutralizing epitopes, thereby averting the production of non-neutralizing antibodies that may promote ADE of disease. Proteins or peptides alone are poorly immunogenic and generally require not only an adjuvant but also repeated administration, and they are poor activators of CD8⁺ T cell responses. Furthermore, this platform is generally unsuitable for respiratory mucosal vaccination [14].

5. DNA and RNA Vaccines

These vaccines have gained popularity due to their cost-effectiveness, ease of design and production, attractive biosafety profile, and, in the case of DNA, stability. Nucleic acid vaccines have gained particular attention for their potential to rapidly produce vaccines against emerging infectious diseases such as those currently being tested against SARS-CoV-2, the causative agent of COVID-19 [15].

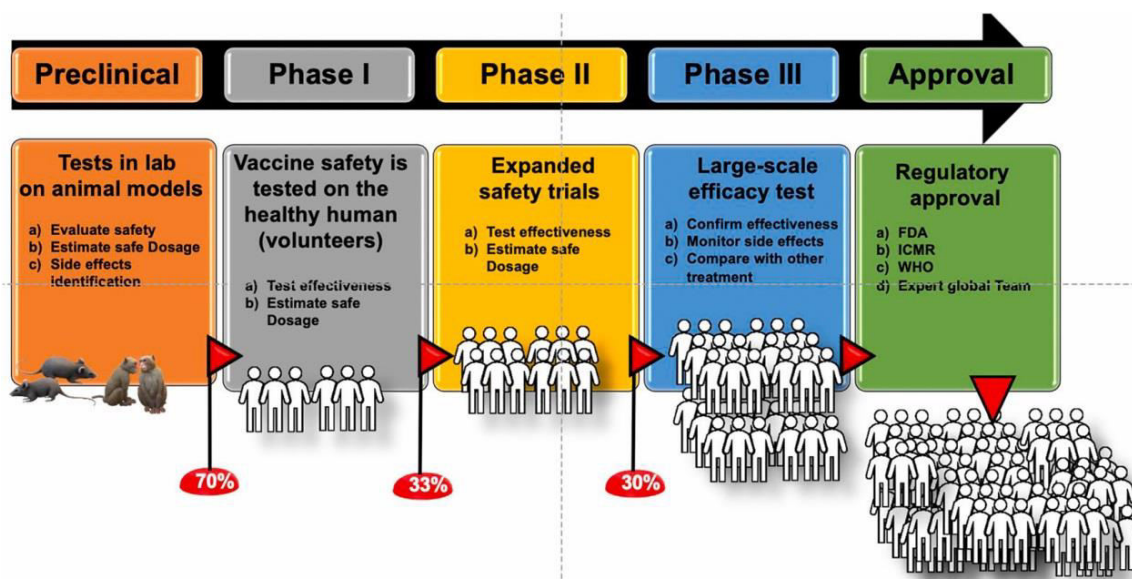
VACCINE DEVELOPMENT DURING THE COVID-19 PANDEMIC

Each stage of vaccine development, including the exploratory stage, preclinical trials, clinical trials, regulatory review and approval, and manufacturing, occurs in sequential order. For COVID-19, the phases of vaccine development have occurred in parallel with simultaneous manufacturing scale-up owing to financial support by OWS (at risk). During phase I trials, small numbers of healthy participants are enrolled to evaluate the initial

safety and reactivity of the vaccine and to begin to determine the dose. Phase II trials evaluate safety and immunogenicity in hundreds of participants, and determine the final dose and schedule. In phase III trials, vaccine is given to thousands of participants and is tested for efficacy and safety. These are typically randomized, controlled, double-blind studies. Ensuring safety of participants is paramount, and strict halting criteria are in place at each phase of vaccine trials.[16]. Being the largest global vaccine provider, India has taken the lead in the development and production of COVID-19 vaccines. Two indigenous vaccine candidates, COVAXIN from Bharat Biotech International and ICMR and a DNA vaccine (ZyCov-D) from Cadila Healthcare, along with other vaccines developed in partnership with foreign collaborators, including the Oxford–AstraZeneca ChAdOx1-S, manufactured by Serum Institute of India (SII) as Covishield; the RBD-S protein vaccine from Biological Evans; the mRNA vaccine of Gennova; and the Sputnik V vaccine, are in various stages of clinical trials. The Indian regulator has provided restricted emergency use authorization for Covishield and Covaxin. On 16 January 2021, India launched the world’s largest immunization program for COVID-19 with the two indigenous vaccines. Being the largest global vaccine provider, India has taken the lead in the development and production of COVID-19 vaccines. Two indigenous vaccine candidates, COVAXIN from Bharat Biotech International and ICMR and a DNA vaccine (ZyCov-D) from Cadila Healthcare, along with other vaccines developed in partnership with foreign collaborators, including the Oxford–AstraZeneca ChAdOx1-S, manufactured by Serum Institute of India (SII) as Covishield; the RBD-S protein vaccine from Biological Evans; the mRNA vaccine of Gennova; and the Sputnik V vaccine, are in various stages of clinical trials. The Indian regulator has provided restricted emergency use authorization for Covishield and Covaxin. On 16 January 2021, India launched the world’s largest immunization program for COVID-19 with the two indigenous vaccines [17].

Stages of vaccine development

A successful COVID-19 vaccine should be extremely safe and pure along with high efficacy and potency rates. In this context, a vaccine candidate should undergo three phases of clinical trials in humans. The vaccine developmental pipeline progresses sequentially: phase I, phase II and phase III, followed by its licensure. Phase IV studies help in continuous monitoring of the safety and immunogenicity of the candidate vaccines [18].



1. Pre-Clinical stage

The candidate vaccine is tested on tissue-culture or cell-culture systems and animals. The safety and immunogenicity are assessed; modifications to the antigen made and different methods are tested for 1–2 years. Animal models provide information about the protective effects, antigen recognition, safety and toxicology aspects of the vaccine [18].

Phase I trials

From the doses obtained on the preclinical animal studies, researchers find out how much of a maximal dose of a drug/vaccine the human body can tolerate. These phase I trials usually aim to find the best vaccine dosage with minimal or no side effects. Phase Ia studies are small trials in healthy, immunocompetent naïve adults who are at low risk of acquiring a vaccine-relevant infection (determined by serology, exposure, and travel history). Phase Ib studies may be conducted in different age or population groups closer to the target population to assess possible differences in dose, safety, vaccine schedule, or route of administration [18].

Phase II Trials

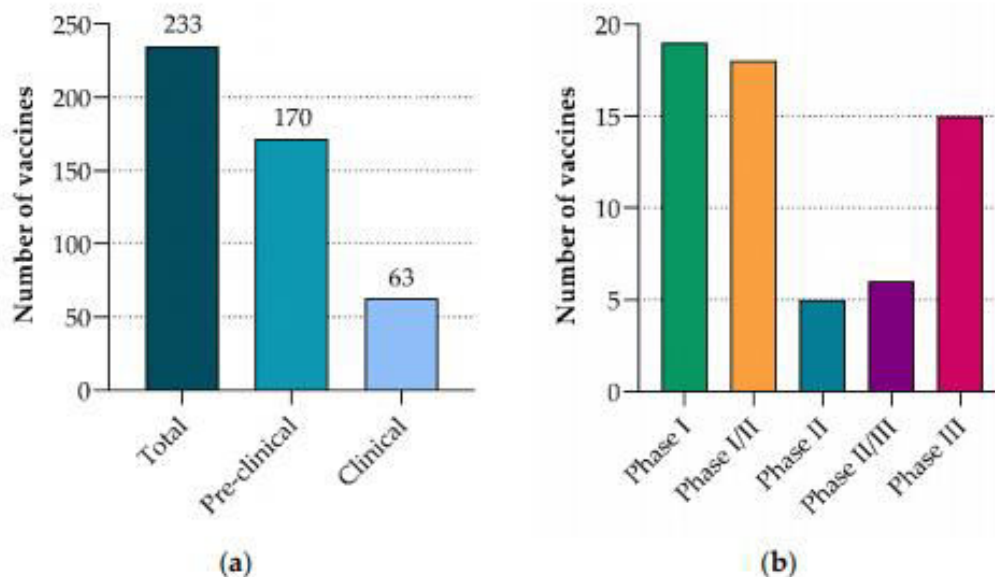
If favorable results are achieved in phase I, candidate vaccines proceed to phase II. The second rabble results are achieved in phase I, candidate vaccines proceed to phase II. The second phase involves testing the vaccine on a larger sample size (100–300) and is expected to provide clinically meaningful information on safety, immunogenicity and efficacy of the candidate vaccine [27]. This phase involves testing the vaccine on hundreds of individuals in the target population at multiple sites, allowing researchers to make conclusions on whether the vaccine is safe, results in the desired immune response, a study to address schedules, age group variations, and duration of follow-up, before proceeding to phase III [23].

Phase III Trials

Phase II trials are usually double-blind studies with a placebo-control group; phase II trials expand the evaluation of the safety and immunogenicity of the vaccine and may include the responses of individuals at risk of acquiring the infection. For a treatable pathogen, trials can be conducted in susceptible adults under controlled conditions to assess the ability of the vaccine to confer protection against experimental challenge. The results of these pilot studies can provide the information necessary to proceed with phase III studies [19].

Phase IV Trials

Phase IV trials may be conducted after a product is licensed, as part of post marketing surveillance. They provide information about the safety and effectiveness of the vaccine in the general population, usually under normal (nonstory) conditions [19].



COVID-19 candidate vaccines. (a)The number of candidates COVID-19 vaccines in preclinical and clinical evaluation [9]. (b) The number of candidate COVID-19 vaccines in different phases of clinical evaluation (Data figures created by Juanita Mallet) [23].

Properties of an ideal COVID-19 vaccine

Excellent safety profile across different age groups and populations

No or few contraindications

Minimal adverse events that are mild and of short duration

Induce protective immunity – ideally after a single dose and gives rapid protective immunity

At least 70% efficacy

Protection in health-care workers who face high-titer virus exposure

Long-lasting protection involving both humoral and cell-mediated responses

If booster doses are required, not more frequent than year.

Rapid mass production, stable at room temperature, easy administration, and which can be co-administered with other vaccines [21]

How Vaccines work

Whenever the virus infects the target tissue in the human body, antibodies are produced to neutralize the organism. Simultaneously, it also induces T-cell-mediated reaction producing lymphocytes which attacks the viral-infected cells and destroys it. This provides capability to fight the infection as well as boosts the immunity of the affected person after recovery from the disease. The duration of immunity is variable based on the different organisms. It is important to note that Type 1 T-cell response is beneficial to provide antiviral immunity whereas Type-2 T-cell response is harmful. The role of the vaccine when given to a person is supposed to induce a similar reaction to provide protection, without escalating the disease to a severe form if contracted. The vaccine induces a similar reaction in the body in a milder controlled way so that the human body becomes immune and can deal with the infection in an effective manner without getting seriously affected. The duration of the immunity provided by the vaccine usually lasts for the same period as provided by the active infection itself. This duration of immunity subsequent to COVID-19 infection is unknown as of today.

VACCINES DEVELOPMENT**Covaxin**

Covaxin is a kind of inactivated vaccine, which one completely safe. India's first indigenous produced vaccine, by Bharat Biotech International Limited of Bangalore in collaboration with ICMR (Indian Council of Medical Research) and NIV (National Institute of Virology) and 25 800 people have been registered for trials across the country (Thiagarajan, 2021). DCGI (Drug Controller General of India) provided approval to Covaxin for the human clinical trial in June 2020 and by July completed Phase-I trial. 12 top institutes of India (AIIMS) New Delhi, AIIMS Patna, Post Graduate Institute (PGI) of Medical Sciences, Rohtak conducted the Phase-I clinical trials for Covaxin on a total of 365 healthy volunteers. The scientific team of Bharat Biotech has declared that participated volunteers remained healthy after vaccination and no adverse effect of vaccines was observed. Hence, the company has completed 2nd dose in the phase-3 clinical with 13,000 volunteers (NHI, 2020)

Covishield

Covishield is an adenovirus vector-based vaccine that is more popular than covaxin. It is a version of the Oxford University Astra Zeneca vaccine with 70.4% efficacy. This vaccine is manufactured by Serum Institute of India and for phase trial 1600 people registered in Nov 2020 (Thiagarajan, 2021) [15]. ZyCoV-D ZyCoV-D is a Plasmid DNA vaccine in which specific gene fragments are cloned into a plasmid. This vaccine was developed in India by Ahmadabad-based biopharmaceutical company Zydus Cadila. Z.

Sputnik- V

This recombinant vaccine was developed for COVID-19 by Gamaleya Research Institute, Russia using human adenovirus vector 26 for the first vaccine and human adenovirus 5 for the second vaccine. At the same time, the effectiveness of the Sputnik V vaccine against COVID-19 has been announced to be 91.6%. However, it may be less effective in the elderly or patients with immunodeficiency. The best immune response also occurs about two weeks after the second dose of the vaccine, but the duration of protection of this vaccine, like other vaccines, is not yet known.

CONCLUSION

The development of a vaccine requires extensive planning and research with regard to its design, production, and purification as well as preclinical trials in model animals to confirm its safety and several stages of human clinical trials to determine its efficacy in disease intervention. There is currently an urgent need for the development of an efficient vaccine against SARS-CoV-2. An effective and safe vaccine will play a significant role in diminishing the escalating transmission and infection of SARS-CoV-2. Currently, the development of a SARS-CoV-2 vaccine is at the initial stages of building a robust platform with which to tackle COVID-19. Although there are similarities between SARS-CoV and SARS-CoV-2, detailed information on the clinical trials, immune responses, and tentative outcomes of a SARS-CoV-2-specific vaccine are necessary. While SARS-CoV vaccines have been found to be effective in animal models, the efficacy of SARS-CoV-2 remains to be verified in humans. Standard protocols are the prerequisites to safeguard human health. Therefore, the corresponding regulatory authorities should evaluate the safety profile of potential SARS-CoV-2 vaccines using an array of virus strains and a variety of animal models.

PREFERENCES OF EMPLOYEES FOR INDOOR PLANTS IN OFFICE INTERIORS**Dr. Pooja Arya¹, Ms. Rutu Modi² and Ms. Monika Pedgaokar³**

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ABSTRACT

For Individual to survive, plants are necessary. Additionally, plants benefit individuals intangibly by enhancing their health. Plants have been brought indoors by people form thousands of years. People's ability to tolerate pain got better, feel less stressed, and be more productive have all been linked to interior plants. Since most of individual's time is spent indoors, designers and architects place a high value on the effects of the indoor environment. In recent years, the performance of buildings in relation to architecture has drawn growing attention. The purpose of this study was to assess the preferences of employees for indoor plants in an office interior.

In this study descriptive research design method was used to find the preferences of employees for indoor plants in an office environment. Snow ball technique was used for sample selection and 120 employees were taken as sample size for present study. The Google form was used to determine the respondents' preference for indoor plants in an office interior. The Google form collects data on users' preferences for indoor plants in workplace interiors.

A study found that 71% of employees choose natural plants, while 29% pick both artificial and natural plants. The majority of employees believed that indoor plants had an impact on a space's surroundings. In their working environment, they primarily prefer money plants. Around plants, most employees are happy, calm, peaceful, and relaxed. By having plants around them they feel fresh and active. As a result, employees nowadays prefer to have plants in their office interior. They feel more energised and alive when there are plants surrounding them.

Keywords: Plants, indoors, office interior, environment and employees etc.

INTRODUCTION

Plants are necessary to life. It is critical to offer workplaces that have a beneficial impact on the employees. People have been growing plants in pots and bringing them inside their homes for thousands of years. Plants and gardening have been thought to be good for people for thousands of years, physically, mentally, and socially. However, until recently, information about the intangible effects of plants on people was based on case studies, such as people saying working in their gardens made them feel better. There are several scientific studies nowadays that demonstrate the interactions between humans and plants, both indoors and outdoors.

Indoor plants can assist to filter the air and maintain a clean environment. Additionally, it enhances the area's visual appeal aesthetically beautiful and catchy. This study offers crucial information that explains the preferences of employees for indoor plants in office interiors.

REVIEW OF LITERATURE

According to Virginia I. Lohr (2010), the stress-relieving advantages of passively seeing plants. It has been established that the addition of plants may considerably improve people's perceptions of a place as well as their mental well-being. It has also been demonstrated to boost productivity and mental performance, as well as lower pain perception. Smith, Andrew James, Tucker, Matthew, and Pitt, Michael (2011) conclude that plants in offices have a significant favourable influence on short-term illness absence, which fell significantly in the area with plants.

Dr. Gurkirpal Singh (2018) has concluded that it should be of great interest to include plants as a work environment asset, since only small investments are necessary in order to establish a green indoor environment.

According to Iris Bakker and Theo van der Voordt (2010), the healthier the plant, the more favourable the influence on humans. It is surprising that researchers were seeking for a physical environment that is good for humans while ignoring the plant itself.

Aini Jasmin, G. , Noorizan, M., Suhardi, M., Murad, A. G. and Ina, K. (2012) suggests that further experiments should be carried out in a controlled environment to improve knowledge of how indoor plants can improve indoor air quality, and thus improve human health and well-being.

OBJECTIVES

To find out preferences of employees for indoor plants in office interiors.

RESEARCH METHOD

1. **Research Design:** A research design is an organisation of conditions and data analysis. It consists of precise strategies for obtaining the required information. This study's research approach was descriptive in nature, which aided in learning about the participants' perspectives.

2. **Operational Definitions:** The terms used in present study were operationally defined as follow:

Indoor plants: Indoor plant is a plant that is grown indoors in places such as offices.

3. **Locale of the Project:** The introduced study was conducted in Vadodara cities of Gujarat, India.

4. **Selection, Description and Development of Tool:-** The current study's aim was prepared in the form of a questionnaire (google form). It was utilised as a data collection tool. It was chosen because the observer can enter information accurately and systematically on a Google form, making it easier for the researcher to maintain track of data. A Google form was created based on the information gathered while reading the evaluations, professional advice, and personal observation.

The information on preferences of employees for indoor plants in office interiors was gathered using a google form. Purposive sampling was the sample technique employed in the current investigation, and a sample size of 120 was chosen.

5. **Establishment of Content Validity:-** The google form regarding preferences of employees for indoor plants in office interiors was prepared and given to five judges from field of interior designing and teaching staff from Department of Family and Community Resource Management, in Faculty of Family and community sciences. Those items were selected which had 80% agreement among judges.

6. **Data Collection:** The Google form was created to preferences of employees for indoor plants in office interiors, and it was delivered to 160 respondents by email and WhatsApp link. The purpose of the investigation was communicated in order to obtain accurate replies. The researcher collected the data in April 2022.

RESULTS / FINDINGS

The full presentation of the data clarifies the assertions. The investigator has made an attempt to provide the study findings in accordance with the goals. The research findings are depicted in the figures below.

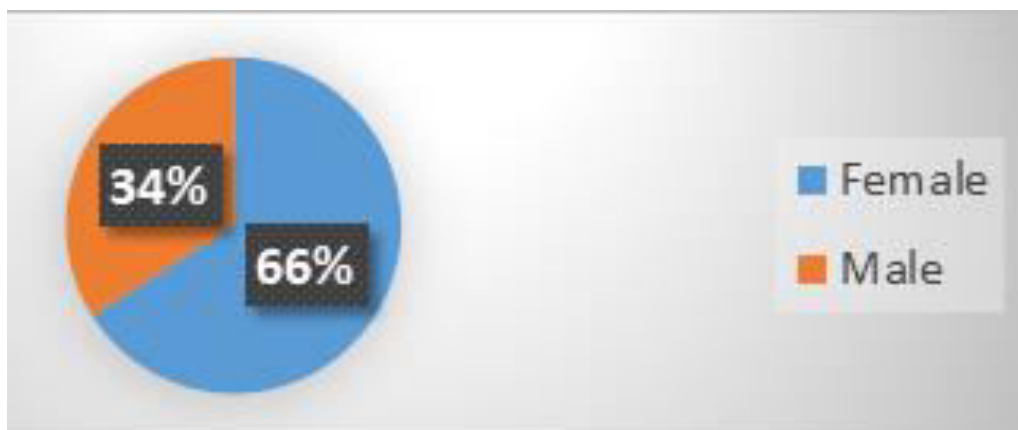
Findings and Discussion Related to Background Characteristics of the Respondents**PERSONAL INFORMATION****1. Gender Proportion**

Figure 1. Frequency and percentage distribution of gender proportion

In the present study fig. 1 shows that, majority of the respondents (66%) were female & 34% respondents were male.

2. Preferences Towards Plants



Figure 2. Frequency and percentage distribution of preferences towards plants

As seen in figure 2., a pie chart explains what kind of plants individuals favour. 71% of respondents prefer natural plants, while the remaining 29% prefer artificial. As seen by graph, none of them picked combination of plants because they are made of plastics, which are harmful to the environment.

3. Indoor Plants Impact the Office Interior

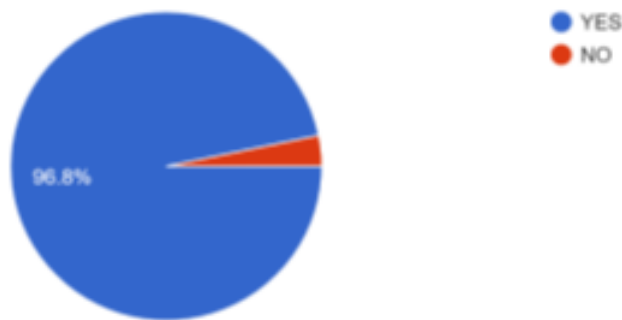


Figure 3. Frequency and percentage distribution of indoor plants impact the office interior

Figure 2 pie chart illustrates how indoor plants impact the office interior. 96.8% of respondents believe that indoor plants have an impact on a space's surroundings. However, just 3.2% of the population believes that it has no impact on the environment. It is concluded that individuals are aware of a plant's value.

4. Preferences Towards Type of Indoor Plants in Office Interior

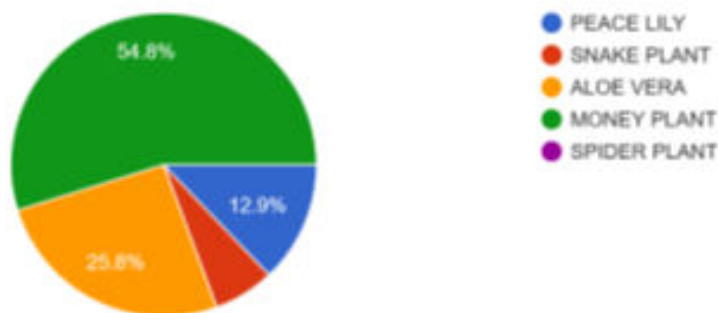


Figure 4. Frequency and percentage distribution of preferences towards type of indoor plants in office interior

Figure 3 illustrates which indoor plants find the most appealing in indoor interior. Majority of respondents (54.8%) have money plants, 12.9% have peace lilies, 25.8% have aloe vera, and 6.5% prefer snake plants. As can be observed, the majority of individuals favour money plants in their locality.

CONCLUSION

It was concluded from study that 71% of employees prefer natural plants, while 29% prefer both natural and artificial plants. The majority of employees agreed that indoor plants had an effect on the office interior. They prefer money plants in their working environment. Most personnel in plants are cheerful, quiet, serene, and relaxed. As a result, today's employees prefer to have plants at their workplace. They feel more energised and alive when they are surrounded by plants.

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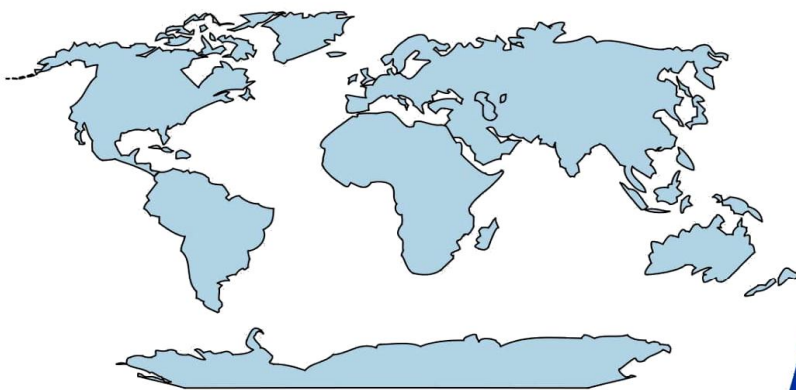
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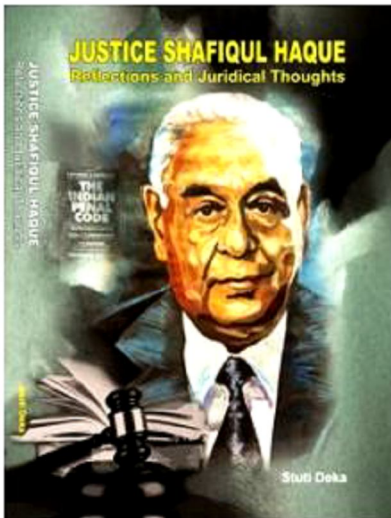


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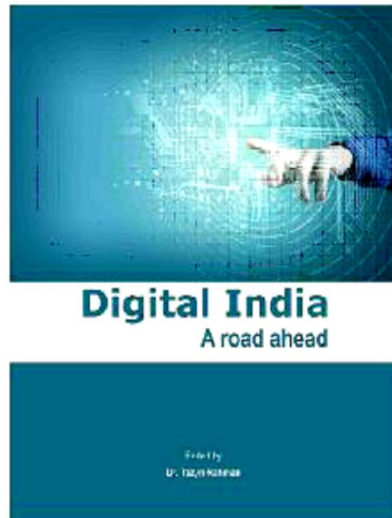
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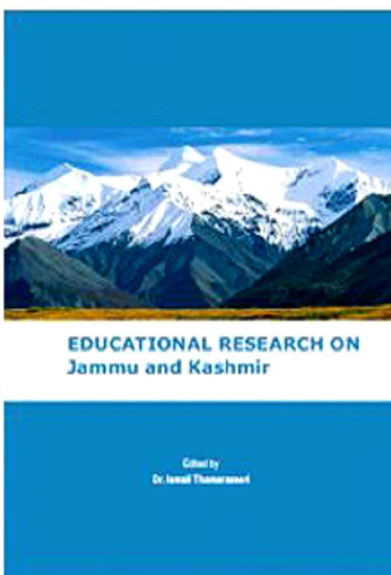
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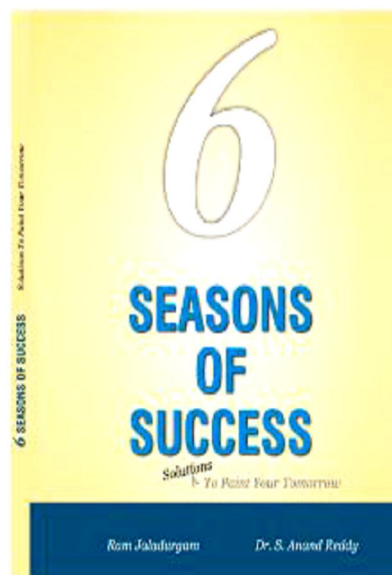
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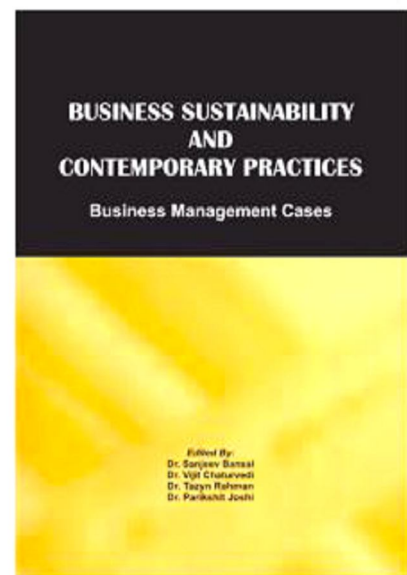
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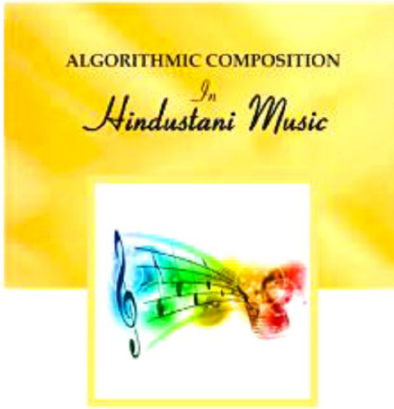
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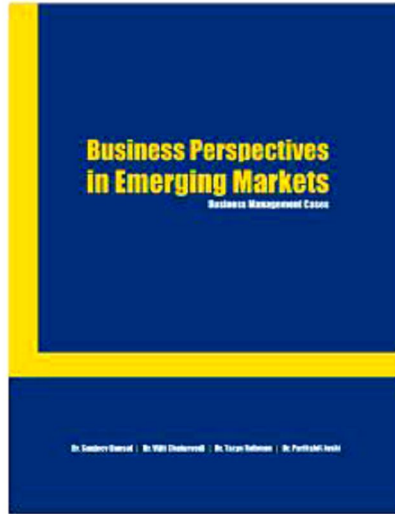


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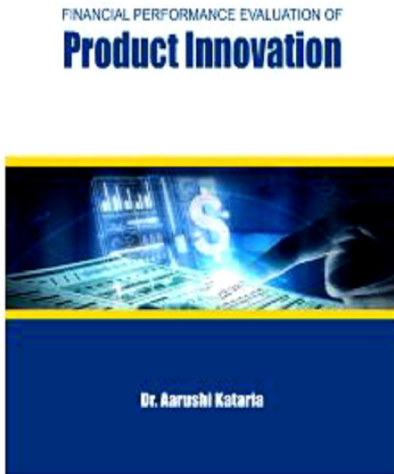


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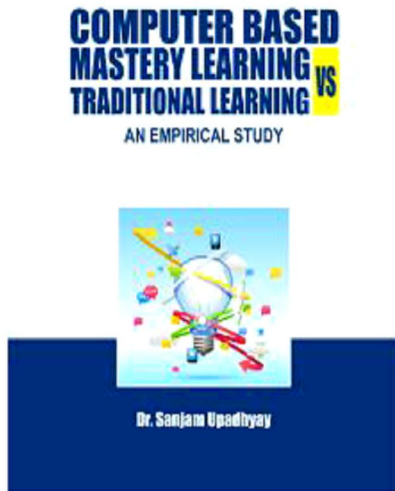
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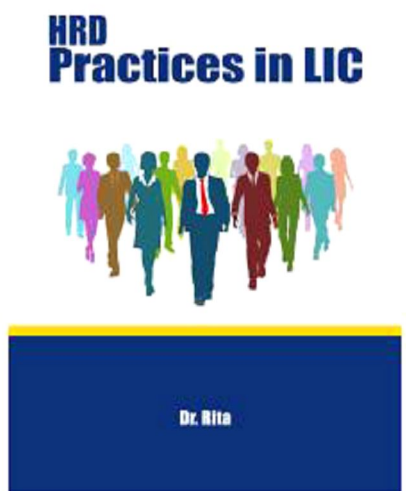
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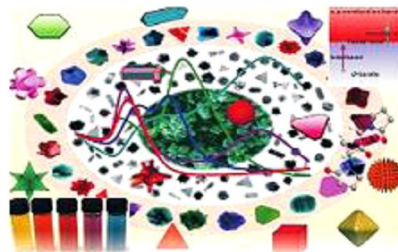
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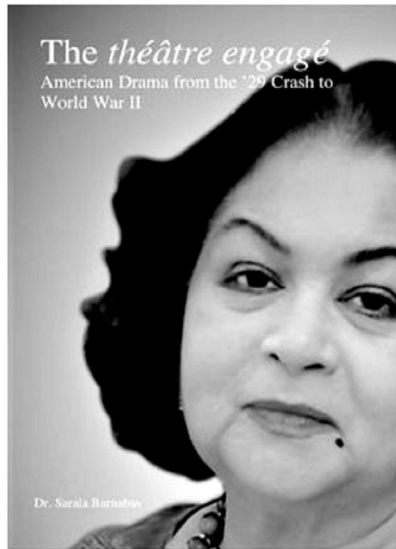
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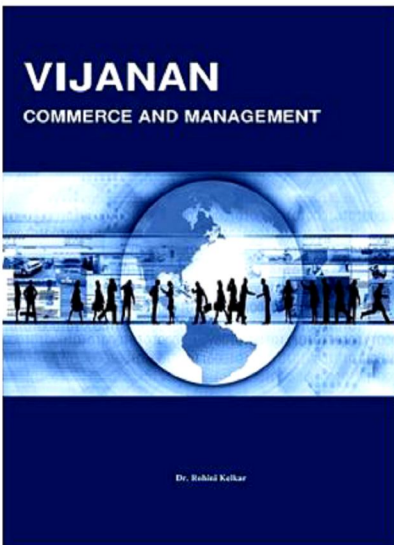
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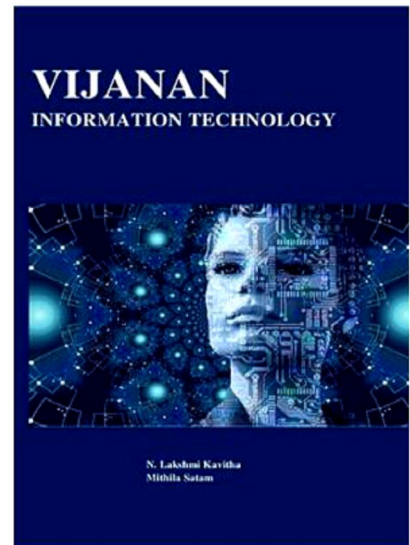
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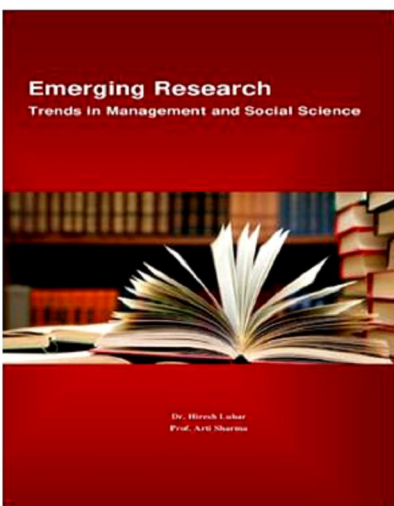
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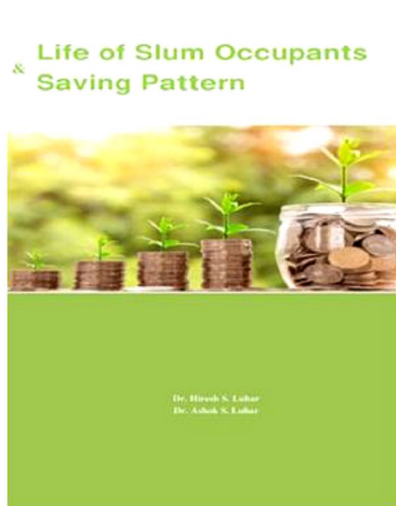
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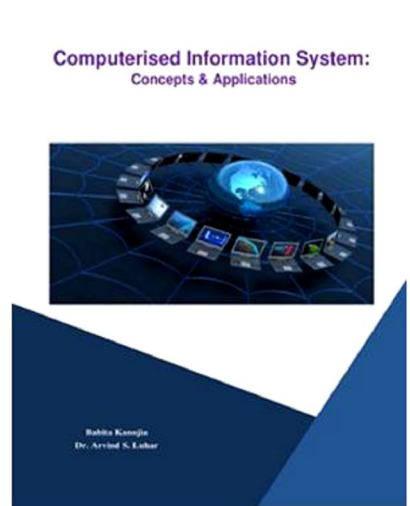
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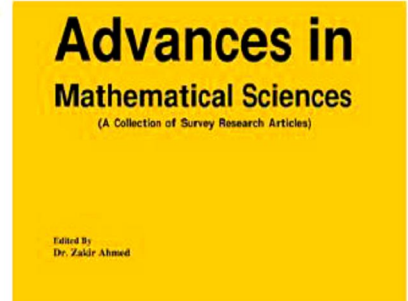
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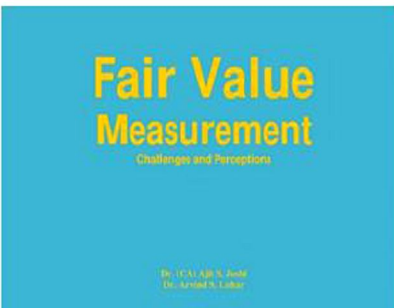
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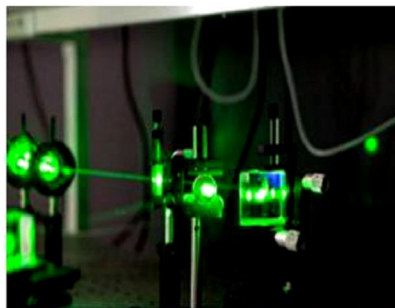
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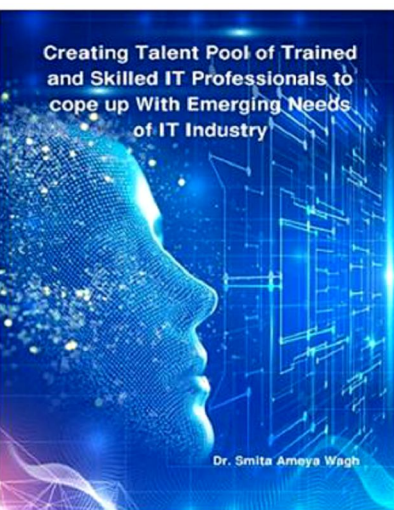


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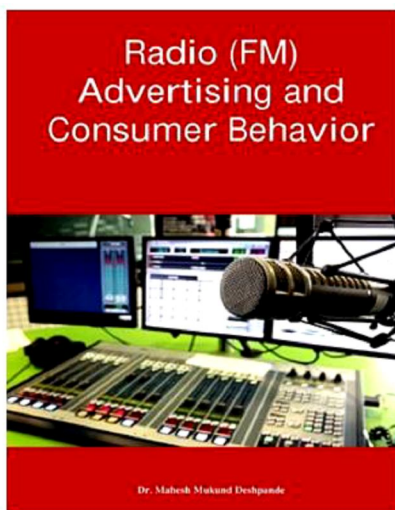
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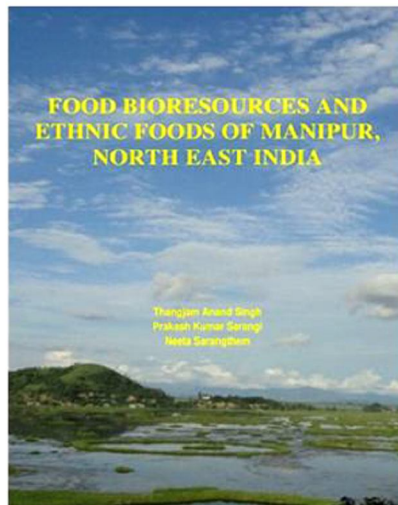
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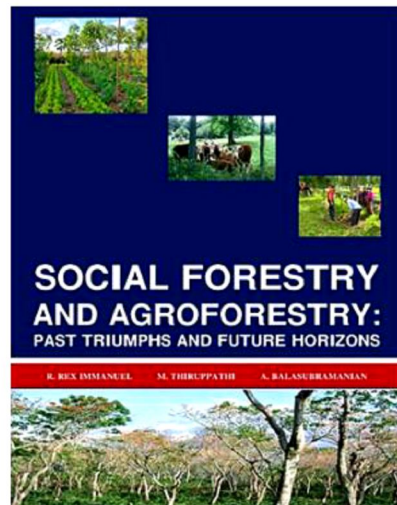
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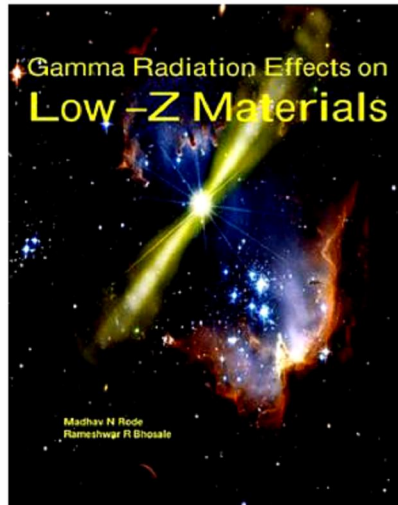
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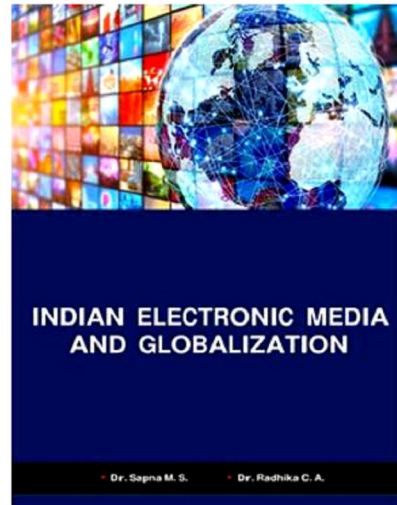
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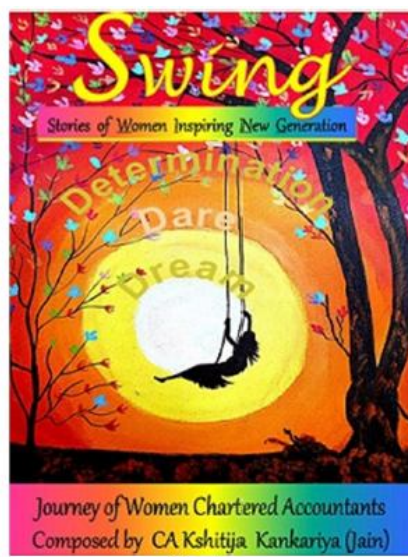
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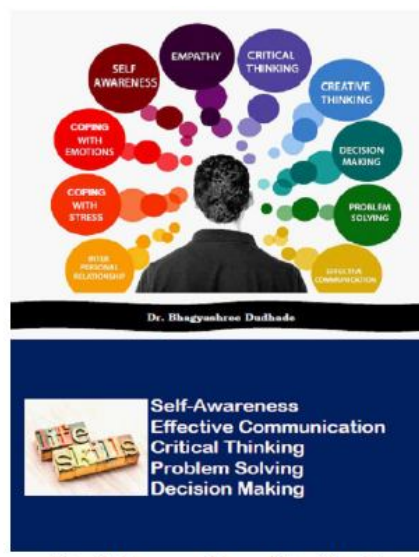
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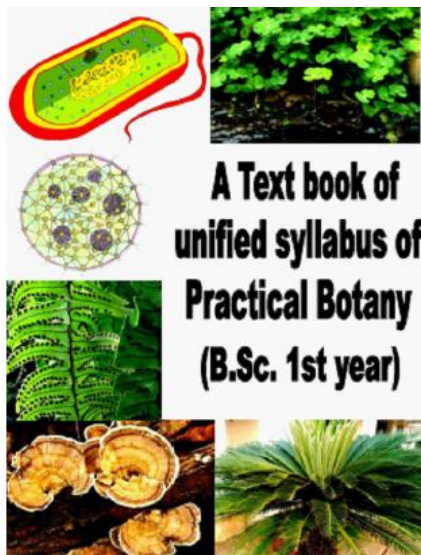
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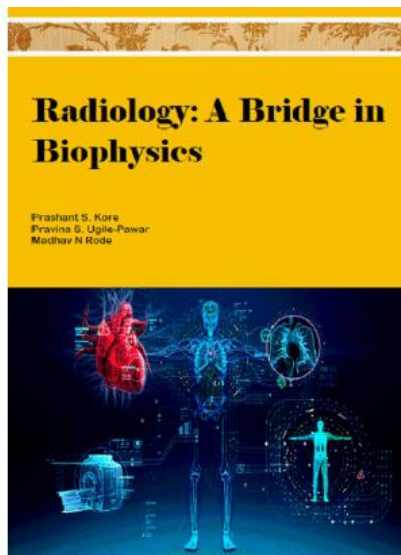


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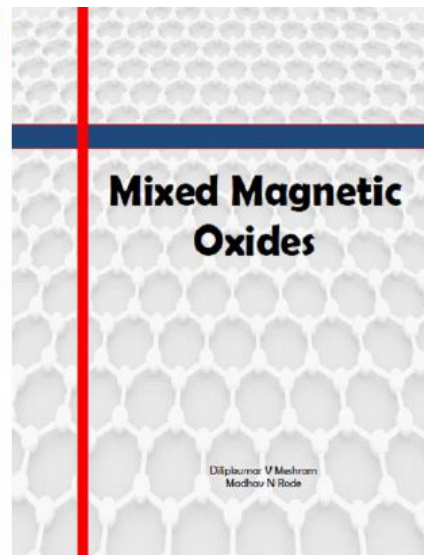
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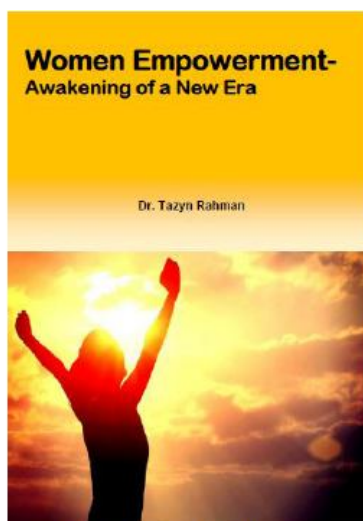
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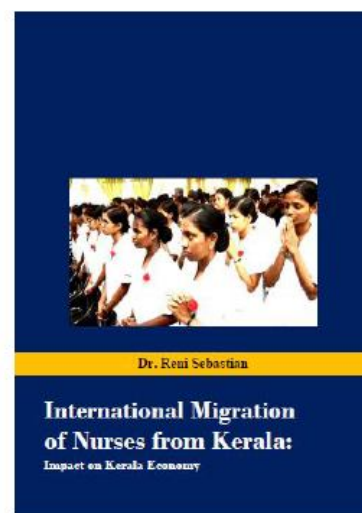
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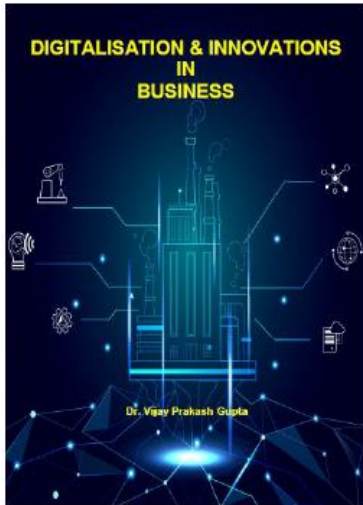
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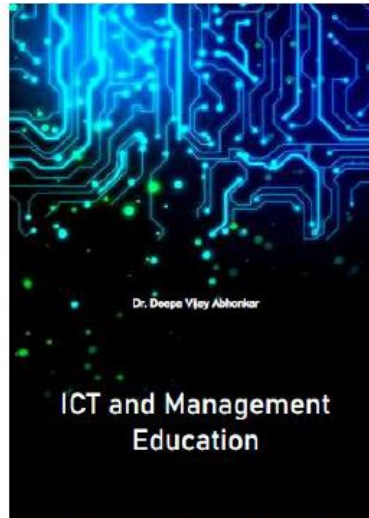
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