Adhyayan

(A Peer Reviewed Referred Journal)

Maharaja Bir Bikram University
Agartala, Tripura

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Maharaja Bir Bikram University is a newly established state University in Tripura. It started its academic journey in 2016 with four Departments- Department of Public Administration, Department of English, Department of Library and Information Sciences and Department of Applied Mathematics. Since inception, the University is maintaining academic standard through different kinds of academic activities such as organizing seminars/conferences at national and international level, involvement of the faculty members in the development of academic discourses through research activities. Publication of an academic journal adds another milestone in the academic arena of a University. Keeping in mind of this, the University has taken an epistemological initiative to publish a bi-annual academic journal in the name of *Adhyayan* with the following objectives:

1. To promote publication through quality researches of academic articles in science, social, economic, security and other related issues of Natural Science, Commerce, Management, Humanities and Social Sciences;
2. To develop critical researches with capacity building, stimulate academic debate and discussion among academic researchers in Natural Science, Commerce, Mangement, Humanities and Social Sciences;
3. T establish an academic linkages between the researcher and research organizations for development of and application of creative knowledge and thinking

It is a peer reviewed referred bi-annaul (January and July) Journal published by the Maharaja Bir Bikram University, Agartala, Tripura. Each issue will include articles, book reviews etc. It will accept manuscripts of Natural Sciences, Commerce, Mangement, Humanities and Social Sciences.

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Message

I am happy to know that Maharaja Bir Bikram University is going to publish the 1st issue of the University's Peer Reviewed Referred journal, 'Adhyayan' very soon. The journal is a testimony to all the teaching and research works being conducted in the University. As a young University, it is indeed a very commendable effort that will bring quality and add knowledge in multidisciplinary areas. I am sure that the journal will certainly become a popular research destination in the near future. I hope that it will cater the professional and academic needs of the faculties and research scholars as well. I look forward to reading the articles and achievements of the journal. Congratulations to the entire editorial team including the authors and I wish that the 'Adhyayan' will see the light of the day in future.

Satyadeo Poddar   19.2.2021

Prof. Satyadeo Poddar
Vice Chancellor
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Editor's Note

Teaching, research and research influence are most essential parts of University's academic activities. Research in Universities can play a pivotal role in nation building. It brings necessary change in science, economic, social and even political spheres. Research fosters professional excellence in faculty and provides opportunities to make difference with critical thinking skills and helps to remain prepared for opportunities and challenges of the future.

Maharaja Bir Bikram University (MBB University) was established in the year 2015. After its establishment, it started its academic journey with four academic Departments-English, Bachelor of Library and Information Science, Applied Mathematics and Public Administration. Since inception, the University has been insisting on pursuance of academic excellence through teaching, research and research influence. Over the years, all Departments have successfully organised seminars/conferences and webinars during the ongoing Covid 19 pandemic situation on many issues of contempoary importance at national and international level with participation of participants and resource persons from different parts of India and many countries of the world. The faculty members have also contributed their research papers in reputed academic journals.

The academic excellence of a University is also measured by academic journals it publishes and how the research papers of these journals are contributing to the boundary of knowledge. In view of academic importance of a research Journal in University, MBB University decided to publish a bi-annual peer reviewed referred multi disciplinary Journal in the name of *Adhyayan*.

The Vol. 1, Number 1, Issue 1 of the Journal, *Adhyayan* has considered nine papers for publication after revsion, if any, as per the comments of the reviewers on the articles. The articles represent interdisciplinary character with pure science, social science and literature background. It is hopeful that these articles will certainly find importance place in the epistemological arena and contribute knowledge to the existing boundary of knowledge.

Editors

Dynamics of a Seasonally Perturbed Modified Leslie-Gower Type Prey-Predator Model with Beddington - DeAngelis Functional Response

Dr. Debadatta Adak*

Abstract

In this work a deterministic modified $Leslie - Gower$ type prey predator model with $Beddington - DeAngelis$ functional response has been proposed and studied both analytically and numerically. Then the deterministic model has been modified by considering effect of seasonality on system parameters representing intrinsic growth rates of prey and predator populations. The seasonally perturbed model has been studied numerically. It has been shown that non-perturbed system fails to show dynamical complexity in prey-predator ecological system. However, numerical analysis indicates that the seasonality plays a key roleto generate various dynamical complexities observed in prey-predator ecological systems. In this regard bifurcation diagrams with respect to the angular frequency of the fluctuations and the scaling factor expressing the impact of predator interference have been drawn. Existence of chaotic oscillations has been confirmed by calculating the largest Lyapunov exponent. The results depict that theseasonality in two different parameters can generate rich and complex dynamics in a simple prey-predator system.

Keywords: *Prey-predator system, Modified Leslie-Gower, Beddington-Deangelis, Seasonality, Bifurcation, Chaos, Lyapunov Exponent.*

1 Introduction

In nature it is often observed that growth and dynamics of various species are dependent on periodically varying environments. Hence to understand the dynamics of any species population in ecology it is important to identify and analyze the functional role that seasons play in the behavior of any population community (Gakkhar and Naji, 2003).

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Seasonal fluctuations and variation can alternate and change various dynamical aspects of an ecologicalsystem. Hence the study of various ecological systems subjected to seasonal perturbations and fluctuations are important for both theoretical and experimental ecologists. According to **Upadhyayand Iyengar, 2005**the study of seasonally perturbed ecological systems should take into account the intrinsic nature of environmental and seasonal perturbations.However, in general the basic problem is to analyze and interpret the relationship between the magnitude of the seasonalvariations and the observed complexity of the system. Various researchers have studied the simple prey-predator systems with seasonal perturbations (**Rinaldi, S. et al., 1993; Gragnani, A.**and **Rinaldi, S., 1995, Baek, H., 2009; Yu et al. 2011**). These studies have shown that these interactions can generate rich dynamics like, strange attractors, catastrophes and chaos (**Parker**and **Chua, 1989**).

It has been well established that critical complex dynamics such as cycles, quasi-cycles, and chaos, can occur incontinuous-time biological systems with three or more species (**Schaffer, W., 1985; Upadhyay** and **Rai, 2001; Gakkhar**and **Naji, 2005; Wang**et al.**, 2007; Lv**and **Zhao, 2008**). Classical Lotka-Volterra or Rosenzweig-MacArthur predator-prey models and its variantsassume that prey population only grows logistically to its carrying capacity but the predator has no such limitation.**Leslie, 1948** for the first time, considered logistic growth of predator population with prey density as its upper limit.Thus, the predator's growth equation contains a negative term which has a reciprocal relationship with per capitaavailability of its preferred prey (**Leslie** and **Gower, 1960; Pielou, E. C., 1969**). In this work we have used a simple, modified Leslie-Gower type prey predator model following the theory of **Aziz-Alaoui, M. A., 2002; Ji, C. et al., 2009; Nindjin, A. F. et al., 2006**and the $Beddington - DeAngelis$ functional response have been used to formulate the prey-predator interactions. This functional response was introduced by **Beddington, 1975** and **DeAngelis et al. 1975**, independently. The main differenceof this functional response from other functional responses is that it contains an extraterm presenting mutual interference by predators (**Baek, H., 2009a**). It is true that without quantitative study the interactions between thepredators and preys cannot be established mathematically. However, it has been often observed in nature that a change in onespecies (prey or predator) can cause a change in the others (predator or prey). Hence we have used $Beddington - DeAngelis$ functional response to describe their relationship with sufficient accuracy in thispaper.

Let $x(t)$ and $y(t)$ respectively be the population densities of the prey population and predator population respectively at any time t. It has been assumed that prey population grows logistically in absence of predator. Let, r_1 and r_2 be the intrinsic growth rates of prey and predator population respectively. The parameter a represents the intra-specific competition of prey species. Clearly $\frac{r_1}{a}$ is the environments carrying capacity towards the prey population. It is assumed that predator consumes prey following $Beddington - Deangelis$ functional response with attack rate α. The parameters β and γ are constants. In this study it is also assumed that the predator is a specialist one, favoring the prey species x. Hence, we assume that if the prey species is rare then it will put a negative impact on the growth of predator population following modified $Leslie - Gower$ functional form. The parameter λ represents the number of prey required to support one predator when maximum per capita growth rate of predator is unity. p is the saturation constant and q is the scaling factor expressing the impact of predator interference. All the parameters are assumed to be positive. Now using the above assumptions we formulate the following deterministic prey-predator interaction model given by system (1.1).

$$\frac{dx}{dt} = r_1 x - ax^2 - \frac{\alpha xy}{1 + \beta x + \gamma y}$$

$$\frac{dy}{dt} = r_2 y^2 - \frac{\lambda y^2}{p + qx} \qquad (1.1)$$

We will study system (1.1) with the following initial conditions given by:

$$x(0) \geq 0, y(0) \geq 0. \qquad (1.2)$$

Now due to seasonal variations of resources the growth of prey population may vary and as a result the growth of predator population will vary too, as we have considered the predator to be a specialist one. We consider the seasonal perturbations to be of sinusoidal type and periodic function of time. Hence the seasonally perturbed growth rate of prey population is given by:

$$r_1 \rightarrow r_1[1 + \epsilon_1 \sin \theta t] \qquad (1.3)$$

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and the same for the predator's growth rate is considered as:

$$r_2 \to r_2[\,1 + \sin(\theta t + \phi)\,].$$ (1.4)

Here ϵ_1, ϵ_2 are the degrees of seasonality; $\epsilon_1 r_1, \epsilon_2 r_2$ are the magnitudes of perturbation; θ is the angular frequency of the fluctuations caused by seasonality. ϕ is the phase angle and $0 \le \phi \le 2\pi$. Clearly $0 \le \epsilon_1, \epsilon_2 \le 1$. When $\epsilon_1, \epsilon_2 = 0$ there is no effect of seasonality. Whereas, $\epsilon_1, \epsilon_2 = 1$ implies maximum level of seasonality. Finally we modify system (1.1) by the seasonally perturbed parameters as defined in (1.3) & (1.4) and obtain the following seasonally perturbed system with $z(t) = \theta t$:

$$\frac{dx}{dt} = r_1 x - ax^2 - \frac{\alpha xy}{1 + \beta x + \gamma y} + r_1 \epsilon_1 x \sin z$$

$$\frac{dy}{dt} = r_2 y^2 - \frac{\lambda y^2}{p + qx} + r_2 \epsilon_2 y^2 \sin(z + \phi)$$ (1.5)

$$\frac{dz}{dt} = \theta \,, \quad z(0) = 0.$$

2 Analytical study of the system (1.1)

Proposition 2.1 *If* $\frac{a\lambda}{ap+qr_1} > r_2$ *then all solutions of system (1.1) are non-negative and ultimately bounded in the region*

$$\Gamma = \{(x, y) \in \ _+^2 : 0 \le x(t) + y(t) \le M\}$$ (2.1)

where $= \max\{M_1, M_2\}$, $M_1 = \frac{(1+r_1)^2}{4a}$, $M_2 = \frac{1}{4}\left[\frac{ap+qr_1}{a\lambda - r_2(ap+qr_1)}\right]$.

Proof. From the first equation of (1.1) it can be clearly seen that

$$\frac{dx}{dt} \le r_1 x - ax^2 \Rightarrow \lim_{t\to\infty} x(t) \le \frac{r_1}{a}.$$ (2.2)

Hence, the solution $x(t)$ of (1.1) is ultimately bounded for sufficiently large $t > 0$. Again, define $V(t) = x(t) + y(t)$. Then differentiating $V(t)$ one would get:

$$\frac{dV}{dt} = \frac{dx}{dt} + \frac{dy}{dt} = r_1 x - ax^2 - \frac{\alpha xy}{1 + \beta x + \gamma y} + r_2 y^2 - \frac{\lambda y^2}{p + qx}$$

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$$\Rightarrow \frac{dV}{dt} \le r_1 x - ax^2 + y^2 \left(r_2 - \frac{a\lambda}{ap + qr_1}\right) \qquad \text{(using (2.2))}$$

$$\Rightarrow \frac{dV}{dt} + V \le [x(1 + r_1) - ax^2] + \left[y + y^2 \left(r_2 - \frac{a\lambda}{ap + qr_1}\right)\right]$$

Define:

$$f(x) = x(1 + r_1) - ax^2 \Rightarrow \max\{f(x)\} = \frac{(1 + r_1)^2}{4a} = M_1 > 0,$$

$$g(y) = y + y^2 \left(r_2 - \frac{a\lambda}{ap + qr_1}\right)$$

$$\Rightarrow \max\{g(y)\} = \frac{1}{4}\left[\frac{ap + qr_1}{a\lambda - r_2(ap + qr_1)}\right] = M_2 > 0 \text{ if } \frac{a\lambda}{ap + qr_1} > r_2 \ .$$

Let, $M = \max\{M_1, M_2\}$. Hence we get

$$\frac{dV}{dt} + V \le M \Rightarrow \lim_{t\to\infty} V(t) \le M \Rightarrow \lim_{t\to\infty}[x(t) + y(t)] \le M.$$

Thus we get all solutions of system (1.1) are ultimately bounded in the region $\Gamma \subset \, \Re_+^2$ as defined in (2.2). Next we show all the solutions of system (1.1) starting with the initial conditions (1.2) are ~~positive~~ using the following Lemma (**Nagumo, 1942**).

Lemma 2.1 *Consider a system $\dot{X} = F(X)$, where $F(X) = [F_1(X), F_2(X), \dots, F_n(X), X \in \, \Re^n$, with initial condition $X(0) = X_0 \in \Re^n$. If for $X_i = 0, i = 1,2,\dots,n$ we get $F_i(X)|_{X_i=0} \ge 0$, then any solution of $\dot{X} = F(X)$ with the given initial condition, say, $X(t) = X(t, X_0)$ will be positive i.e., $X(t) \in \, \Re_+^n$ for all $t > 0$.*

Now define $X(t) = (x(t), y(t))$. It can be easily seen from system (1.1) that

$$\left(\frac{dx}{dt}\right)_{X=0} = 0, \left(\frac{dy}{dt}\right)_{X=0} = 0.$$

Therefore, following **Yang et al., 1996** we get that Γ is an invariant set of $\Re_+^2$. Thus all the solutions of system (1.1) are positive and ultimately bounded in Γ. Hence the proposition.

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2.1 Equilibrium points and their stability

System (1.1) has three equilibrium points, namely, extinction equilibrium $E_0(0,0)$, which always exists; predator-free equilibrium $E_1\left(\frac{r_1}{a}, 0\right)$ which too always exists and the coexistence equilibrium points $E^*(x^*, y^*)$ where $x^* = \left(\frac{\lambda}{r_2} - p\right)\frac{1}{q}$ & $y^* = \frac{(ax^*-r_1)(1+\beta x^*)}{\gamma(r_1-ax^*)-\alpha}$. E^* exists uniquely if $\lambda > \lambda^* = \max\left\{pr_2, pr_2 + \frac{qr_2}{a}\left(r_1 - \frac{\alpha}{\gamma}\right)\right\}$. To determine the local stability of the equilibrium points we use linearization technique and obtain the Jacobian matrix evaluated at E_0 as:

$$J_0 = \begin{pmatrix} r_1 & 0 \\ 0 & 0 \end{pmatrix}.$$

Hence, we get unstable manifold about E_0 along $x-$axis. Similarly, the Jacobian matrix determined at E_1 is given by

$$J_1 = \begin{pmatrix} -r_1 & -\dfrac{\alpha r_1}{a + \beta r_1} \\ 0 & 0 \end{pmatrix}.$$

Clearly, we obtain stable manifold about E_1 along $x -$ axis and E_1 is a saddle non-hyperbolic point. Regarding the stability of the coexistence equilibrium E^* we state the following theorem.

Theorem 2.1 *The coexistence equilibrium E^* of system (1.1) is locally asymptotically stable if and only if* $\frac{\alpha\beta y^*}{(1+\beta x^*+\gamma y^*)^2} < a.$

Proof. The Jacobian matrix for E^* is given by:

$$J_* = \begin{pmatrix} m_{11} & m_{12} \\ m_{21} & m_{22} \end{pmatrix}$$

where

$$m_{11} = \frac{\alpha\beta x^* y^*}{(1+\beta x^*+\gamma y^*)^2} - ax^* \;,\quad m_{12} = -\frac{\alpha x^*(1+\beta x^*)}{(1+\beta x^*+\gamma y^*)^2} < 0,$$

$$m_{21} = \frac{\lambda q(y^*)^2}{(p+qx^*)^2} > 0 \;,\quad m_{22} = 2y^*\left(r_2 - \frac{\lambda}{p+qx^*}\right) = 0.$$

The characteristic equation of J_* is given by:

$$\xi^2 + A\xi + B = 0, \qquad\qquad (2.3)$$

where $A = -m_{11}$, $B = -m_{12}m_{21} > 0$. Now, E^* will be stable if and only if all eigen values of J_* have negative real part, i.e., if all the roots of equation (2.3) have negative real part. Hence, E^* will be locally asymptotically stable if and only if $m_{11} < 0 \Rightarrow \frac{\alpha\beta y^*}{(1+\beta x^*+\gamma y^*)^2} < a$. Hence the theorem is proved.

3 Numerical simulations

First we analyze model system (1.1) numerically with the following parameter values:

$$r_1 = 1, r_2 = 0.3, a = 1, \alpha = 1, \gamma = 0.05, \lambda = 0.4, p = 1, q = 1.5. \qquad (3.1)$$

Now for $\beta = 1.3$ we get $E^* = (0.2222, 1.043)$. This E^* exists uniquely as $\lambda = 0.4 > \lambda^*$. One can calculate $m_{11} = -0.0547 < 0$. Hence following Theorem 2.1 coexistence equilibrium E^* is locally asymptotically stable (Fig. 1a). Again for $\beta = 2.3$ we get $E^* = (0.2222, 1.2229)$, $\lambda^* = 0.3$, $m_{11} = 0.0306 > 0$. Therefore, for these parameter values we get a unique E^* which is unstable following Theorem 2.1 (Fig. 1b). The phase trajectories of these cases have been drawn in Fig. 1 for different initial points.
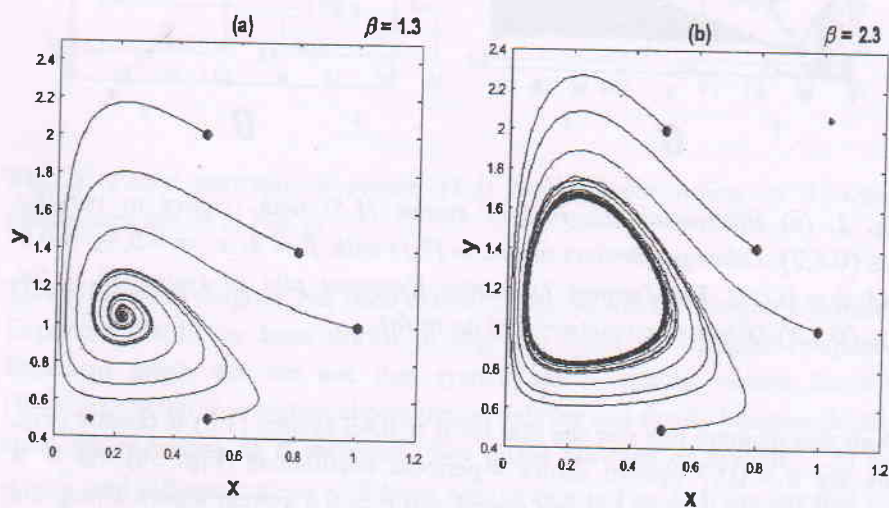

Fig. 1. *The phase portraits of system (1.1) for $\beta = 1.3$ (a) and $\beta = 2.3$ (b). Other parameters are as (1.9).*

Next we analyze the model system (1.5), i.e., the seasonally perturbed system. In this purpose we consider the parameter set given in (3.1) along with $\epsilon_1 = 0.5, \epsilon_2 = 0.9, \phi = 0, \frac{\pi}{2}, \pi$. First we vary θ in the range $\theta \in (0.4,2)$ and draw the bifurcation diagram of the system (1.5) with respect to $x-$ population (Fig. 2a) considering the phase angle $\phi = 0$. This figure shows that system is chaotic for $\theta \in (0.4,0.55)$ and the Largest Lyapunov Exponent graph drawn in Fig. 2b corroborates this fact. As θ is increased further we observe period halving and finally highly aperiodic oscillations. Phase portraits of system (1.5) for different values of θ have been drawn in Fig. 3.

(a)   **(b)**
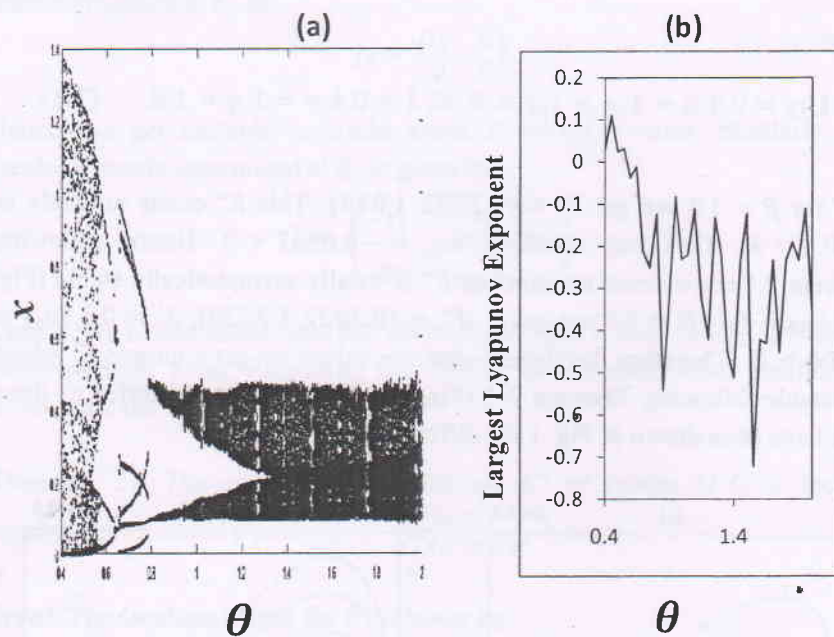
Fig. 2. (a) *Bifurcation diagram of system (1.5) with respect to varying* $\theta \in (0.4,2)$. *Other parameters are as in (3.1) with* $\beta = 2$, $\epsilon_1 = 0.5, \epsilon_2 = 0.9$ *and* $\phi = 0$. *(b) The Largest Lyapunov Exponent plot of system (1.5) for* $\theta \in (0.4,2)$. *Other parameters are as in (a).*

From this diagram one can see that for $\theta = 0.45$ system (1.5) is chaotic (Fig. 3a), for $\theta = 0.57$ system shows 4-periodic oscillations (Fig. 3b). As θ is increased further period halving occurs and $\theta = 0.6$ system shows 2-periodic oscillations (Fig. 3c) and for $\theta = 0.8$ system becomes 1-periodic (Fig. 3e). But

as θ is increased system shows highly aperiodic behavior as it can be seen from Fig. 3f, 3g, 3h that have been drawn for $\theta = 0.8, 1.27, 1.4$ respectively. Next keeping all other parameters same we draw the bifurcation diagram of system (1.5) with respect to $\theta \in (0.4, 2)$ taking the phase angle $\phi = \frac{\pi}{2}$.
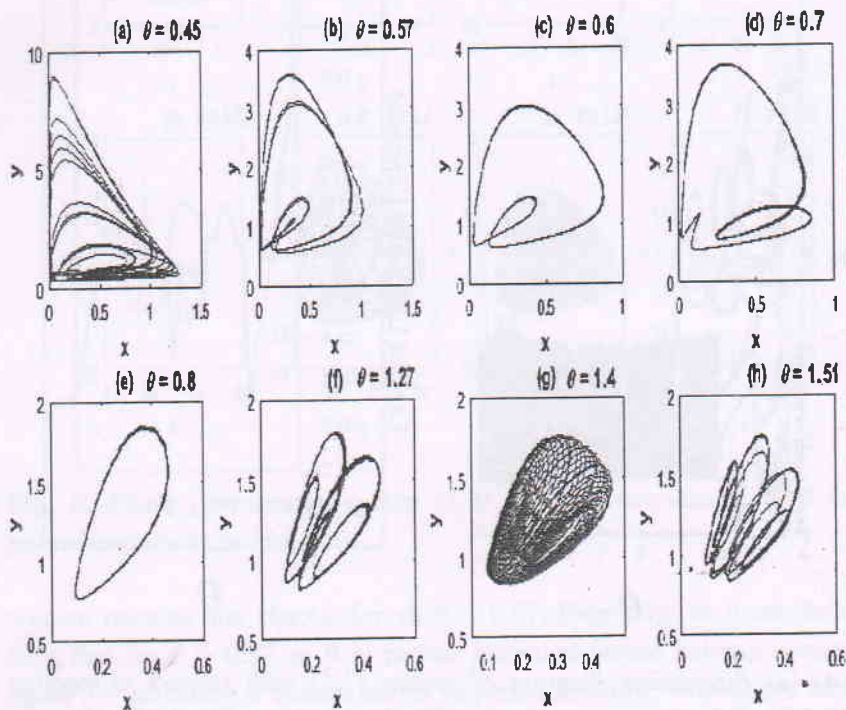
Fig. 3. *Phase portraits of system (1.5) for different values of θ. Other parameters are as in Fig. 2.*

This bifurcation diagram has been drawn in Fig. 4a and the Largest Lyapunov Exponent graph has been drawn in Fig. 4b. From the Largest Lyapunov Exponent graph we can see that system shows chaotic nature for $\theta \in (0.4, 0.53)$. After that system shows period halving and finally becomes highly aperiodic in nature as θ increases. The phase portraits of system (1.5) for $\phi = \frac{\pi}{2}$ and different values of θ have been drawn in Fig. 5. It depicts that for $\theta = 0.4$ system (1.5) is chaotic (Fig. 5a), for $\theta = 0.55$ system shows 4-periodic oscillations (Fig. 5b). As θ is increased further period halving occurs and $\theta = 0.6$ system shows 2-periodic oscillations (Fig. 5c) and for $\theta = 0.75$

system becomes 4-periodic again (Fig. 5d). But as θ is increased system shows highly aperiodic behavior as it can be seen from Fig. 5e, 5f, 5g, 5h that have been drawn for $\theta = 1.02, 1.2, 1.26, 1.76$ respectively.

(a)   **(b)**
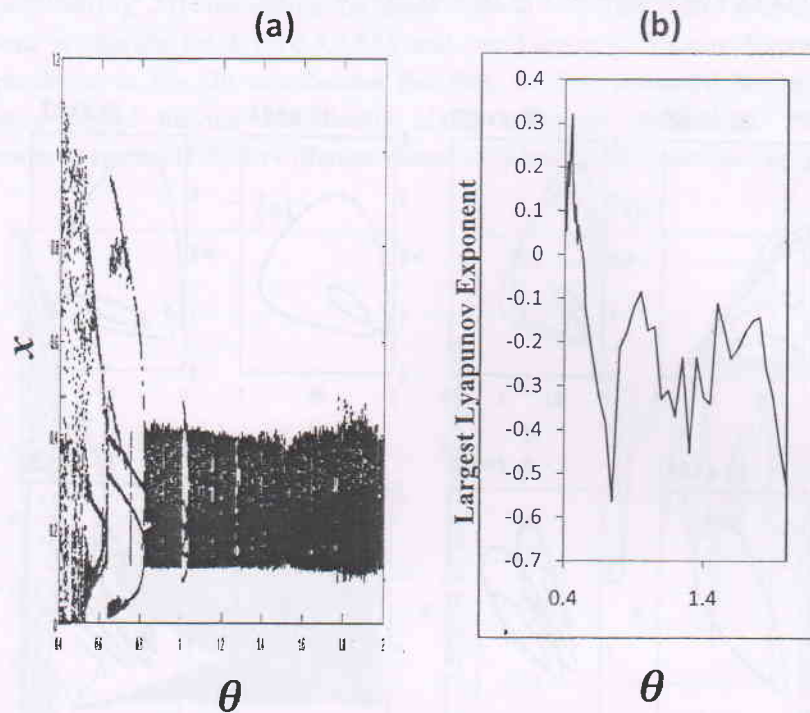
Fig. 4. (a) *Bifurcation diagram of system (1.5) with respect to varying $\theta \in (0.4,2)$. Other parameters are as Fig 2 with $\phi = \pi/2$. (b) The Largest Lyapunov Exponent plot of system (1.5) for $\theta \in (0.4,2)$. Other parameters are as in (a).*

Finally we take the phase angle as $\phi = \pi$ and keeping all other parameters same as in Fig. 2 we draw the bifurcation diagram of system (1.5) for $\theta \in (0.4,2)$. This bifurcation diagram has been given in Fig. 6a. Respective Largest Lyapunov Exponent graph (Fig. 6b) shows that system remains chaotic for $\theta \in (0.4,0.57)$.
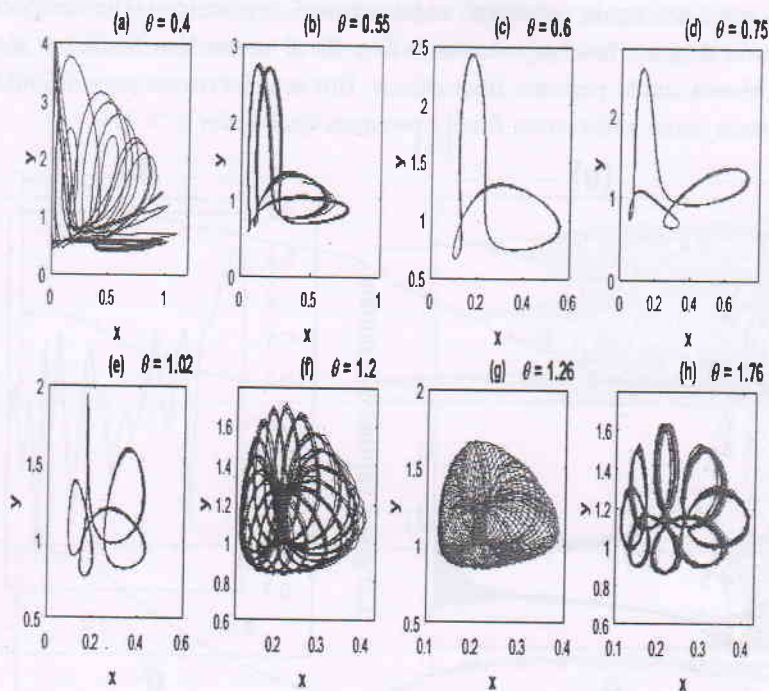
Fig. 5. *Phase portraits of system (1.5) for different values of* θ. *Other parameters are as in Fig. 4.*

System remains non chaotic for all θ > 0.57. From Fig. 6a it can be easily seen that for θ > 0.57 as θ is further increased period halving occurs. But again for increasing θ system moves to period doubling bifurcations and then again period halving occurs. Finally system exhibits one periodic oscillation for all θ > 0.77. Therefore, for phase angle $\phi = \pi$ system remains much more predictable than for the former two cases when $\phi = 0$ or $\phi = \pi/2$.

Next we numerically analyze system (1.5) with respect to the parameter q. For that we fix θ at θ = 0.5 & ϵ = 0.6667 and vary q in the range $q \in (0.2, 2)$ for different phase angles. First we take $\phi = 0$. Bifurcation diagram for this case has been drawn in Fig. 8a. It shows that for lower values of q system is single periodic and unstable. But with increasing q period doubling bifurcation occurs and system shows chaotic oscillations for all $q > 1.35$. Next keeping all other parameters same we take $\phi = \pi/2$. In Fig. 8b corresponding bifurcation diagram has been drawn. From Fig. 8b we can see that for these parameter values system (1.5) never exhibits chaotic oscillations. Whereas, for

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$\phi = \pi$ we can again observe some critical dynamics. The respective bifurcation diagram has been drawn in Fig. 8c. It shows that for $0.2 < q < 1$ system shows single periodic fluctuations. But as q increases period doubling bifurcations occur and system finally becomes chaotic for $q > 1.4$.
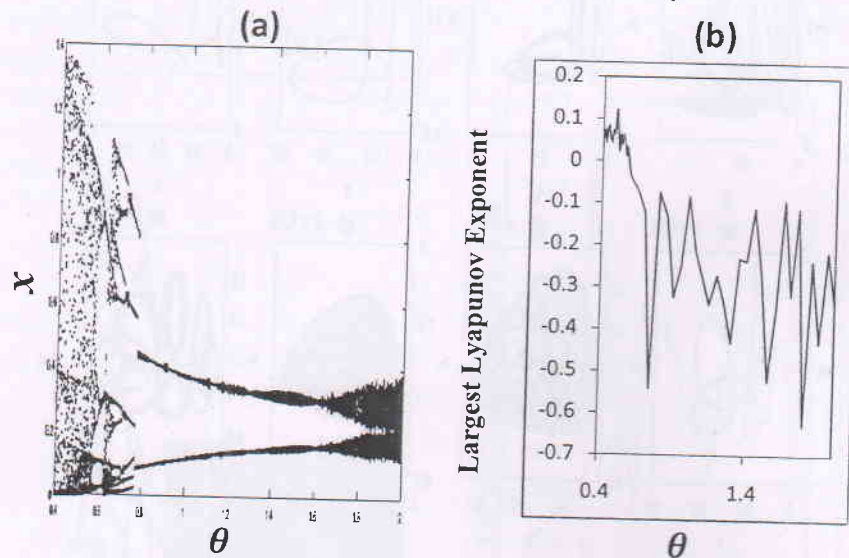
Fig. 6. (a) *Bifurcation diagram of system (1.5) with respect to varying* $\theta \in (0.4, 2)$. *Other parameters are as Fig 2 with* $\phi = \pi$. *(b) The Largest Lyapunov Exponent plot of system (1.5) for* $\theta \in (0.4, 2)$. *Other parameters are as in (a).*

4 Conclusions

In this paper a modified *Leslie – Gower* type prey-predator model with *Beddington – DeAngelis* functional response has been considered and studied in absence and presence of seasonal perturbations. The analysis of the non-perturbed model has been done both numerically and analytically. Whereas, the effect of seasonal variations of the system has been studied numerically. It has been shown that in absence of seasonal fluctuations the system fails to exhibit complex dynamics. The coexistence equilibrium in this case either is stable or shows single periodic oscillations. However, in presence of seasonal fluctuations system shows very critical and rich dynamics such as chaos, period doubling, highly aperiodic strange attractors etc. It has been observed that system shows chaotic oscillations for different values of ϕ when θ is varied. However, with respect to fixed θ and varying q if we take

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$\phi = \pi/2$ there exist no chaotic oscillations. This result may be used to control chaotic fluctuations observed in the real-time prey-predator systems.
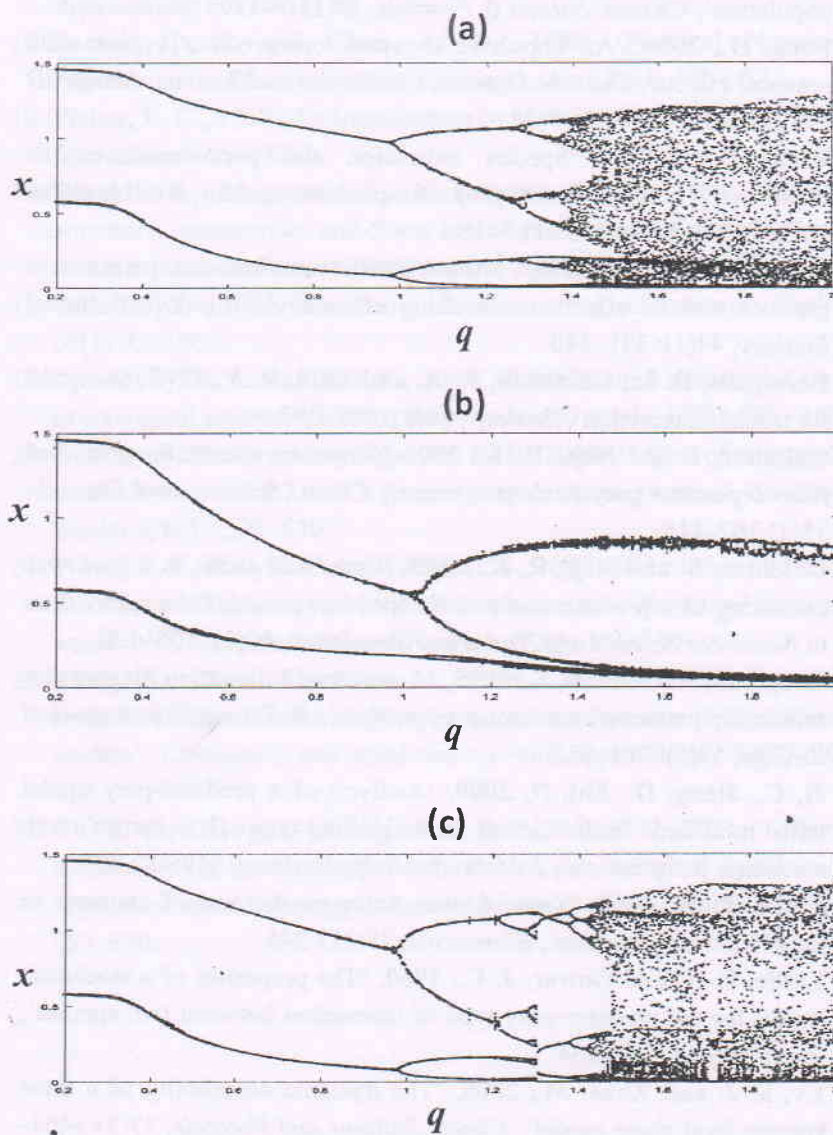
Fig. 8 *Bifurcation diagrams of system (1.5) for varying $q \in (0.2, 2)$ and different values of ϕ. (a) $\phi = 0$, (b) $\phi = \pi/2$, (c) $\phi = \pi$. Other parameters are as in Fig. 2 with $\theta = 0.5$ and $\epsilon_2 = 0.6667$.*

$\phi = \pi/2$ there exist no chaotic oscillations. This result may be used to control chaotic fluctuations observed in the real-time prey-predator systems.

(a)

(b)

(c)
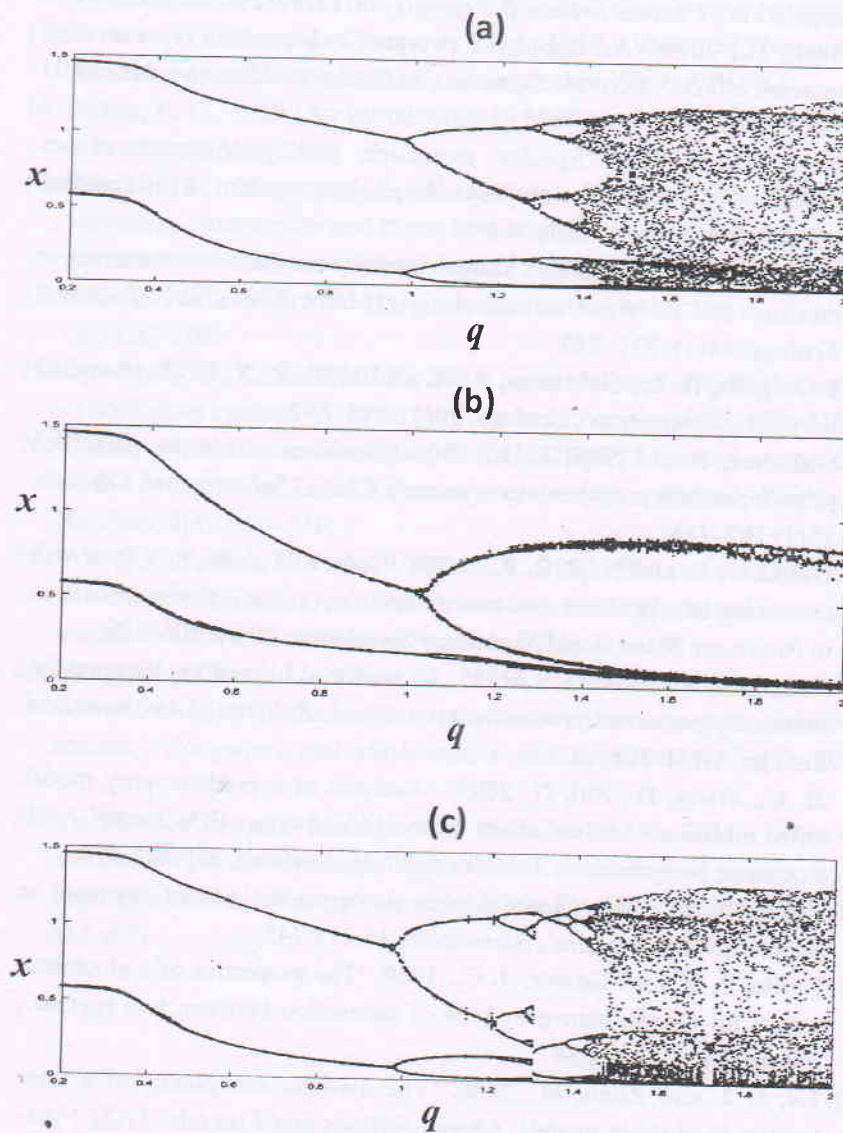
Fig. 8 *Bifurcation diagrams of system (1.5) for varying $q \in (0.2, 2)$ and different values of ϕ. (a) $\phi = 0$, (b) $\phi = \pi/2$, (c) $\phi = \pi$. Other parameters are as in Fig. 2 with $\theta = 0.5$ and $\epsilon_2 = 0.6667$.*

5 References

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Characteristic Variation of Atmospheric Vertical Electric Field during Thundercloud Activity over Agartala

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Abstract

Latest satellite image reveals North-East India to be one of the prominent sources of lightning activity. Exploration of electrical characteristics of thunderclouds within this region requires more data base. The present paperreports the results of observations of the atmospheric Vertical Electric Field (VEF) during several thunder active days in North-East India. The thunder-active sessions are divided into two groups. For Gr-I, lightning occurred mostly at the initial phase whereas for Gr-II, lightning occurred during the total period of the thunderstorm with no specific patterns. The average rate of lightning strokes for Gr-II thunderstorm is around 2.3 times the Gr-I thunderstorms. The average electrical conductivity of the thundercloud is found to be 1.2×10^{-12} $S.m^{-1}$. The average change of VEF is found to be around 1.5 $kV.m^{-1}$. The results are discussed in terms of the presence of strong lower positive charge centers (LPCC) inside the thunderclouds produced over this region.

Keywords: Tropical thunderstorm; Atmospheric vertical electrical field; Electrical conductivity of thundercloud

1. Introduction:

From the eighteenth century, an extensive research on lightning induced electric field is going on all over the world to exemplify the electric field produced due to lightning strokes. This is due to the fact that lightning observations have stimulated interest in their meteorological implications and also have revitalized interest in the Global Electric Circuit (GEC) (Füllekrug, 2004). Both experimental and theoretical works about the electrical environment during thunderstorm period have focused on the cloud electric field and its changes caused by the lightning discharge provide valuable information about the dynamical electrification processes evolved throughout

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the thunderstorm (Sun and Chun, 2002). Wilson was the first scientist toobserve from ground based measurements of systematic variations in the polarity of both the relatively steady electric fields of thunderclouds and the transient electric field changes due to lightning (Rakov and Uman, 2003).

The formation, intensification and propagation of the thunderstorms are mostly governed by the synoptic situation and local thermodynamic conditions of the atmosphere (Ortega et al., 2011). The electrical characteristics are significantly affected with the severity of the lightning activity during the thunderstorm period. A very few attempts have been made to understand the growth and propagation of thunderstorms with the help of the electric field produced by the thunderclouds. Due to nonlinearity in the cloud dynamics and the small temporal and spatial extension, it is difficult to forecast the severity of the thunderstorm (Litta and Mohanty, 2008). In India, studies related to the clouds during intense thunderstorm events are mainly confined observational investigations by several groups using radar, aircraft and satellite observations.

We observe a very few reports about the lightning characteristics of tropical thunderstorms over North-Eastern India. It is important to study the electric field variation under thunderstorm from North-East India since it is located in the vicinity of the Himalayas as well as the Bay of Bengal, owing to very high lightning activity in this region (Goswami et al., 2010). Among the few reports available over North-East India, Guha and De (2009) studied the electrical characteristics of thunderstorms occurring in Northeast region of India using the integrated field intensity of Sferics (IFIS) and found some distinct peaks in the VLF range between 1.5 kHz to 6 kHz (Guha and De, 2009). Pawar et al., (2010) observed the different stages of the thunderstorm at a North-Eastern Indian station, Guwahati and suggested that Lower Positive Charge Centers (LPCC) plays an important role in the initiation of lightning at different stages of the thunderstorm. Latest NASA satellite image reveals North-East India being one of the prominent sources of lightning activity in the entire globe. Cherrapunji, being the region of highest rainfall (average yearly rainfall ~ 12,000 mm), lies within the boundary of North-East India and exploration of electrical characteristics of thunderclouds within this region requires more investigation to find out its contribution to Global Electric Circuit.

In this paper, we are reporting the preliminary results regarding the measurements of lightning electrical characteristics in the state of Tripura located in North-East India. Here, we investigated the characteristics of field

change during the severe lightning activity. We also analyzed the temporal evolution of lightning activity and the change in electrical conductivity from the relaxation time analysis from the electrostatic discharge during the thunderstorm activity. The results are discussed in terms of the presence of strong lower positive charge centers (LPCC) inside the thunderclouds produced over this region.

2. Instrumentation:

The equipment used for the present study for the measurement of atmospheric vertical electric field is a BOLTEK EFM – 100 atmospheric Electric Field Monitor (EFM), installed at the roof at a height of 15 meter at the Department of Physics, Tripura University from ground, (Lat: 23.50^0N, Long: 91.25^0E). The sensor of radial dimension of 17 cm at the EFM consists of six plates arranged symmetrically around the rotating axis. Six electronically controlled mechanically grounded conductive choppers are used to alternately shield and expose six sensor plates to the atmospheric DC electric field. The electrodes are alternately exposed to and then shielded from the field to be measured. The electric current which flows to and fro the electrodes is proportional to the strength of the electric field. This oscillating charge produces an alternating current which is then converted to an AC voltage. The magnitude of the voltage is proportional to the intensity of the external electric field. This voltage is amplified and fed into an analog to digital converter. The data is stored in the computer with a sampling rate of one per second. The internal clock of the computer is synchronized with a GPS receiver. The EFM can measure the electric field variation up to the range of -3.2 kV.m^{-1} to +3.2 kV.m^{-1} with a resolution of 10 V.m^{-1} at the roof where it is located. The EFM is capable of detecting lightning discharge within a radius of 300 km.

3. Calibration of the electric field monitor:

The installation and the maintenance of the EFM are very important for the collection of the authentic data to give any scientific explanation about the electric field variation at any place. As mentioned in earlier studies that the EFM should be kept in a pit with the sensor plates flush to ground and pointing upward direction because at the ground, the lines of force incident on the EFM are parallel to each other provide proper measurement of the field. In the vicinity of the monitor, there should not be any high constructions or trees which may shield or divert the electric lines of force and reduces the

effective field strength. Furthermore the EFM should be placed in a place where the field mill run for long duration and provide easy access for maintaince and cleaning. In our observational site, it was very difficult to get such an ideal place at the ground due to the presence of high buildings and trees. Therefore, to avoid the shielding of lines of force at the ground, we installed the monitor at the roof which is 15 meter above the ground. The electric field enhanced several times with respect to the normal ground level due to the accumulation of field lines at the monitor. The sensitivity plug provided with the EFM reduced the sensitivity and increased the overall measuring range. To compare the data of EFM with the ground, proper calibration of the EFM required regularly. We calibrated the EFM in the fair-weather condition to get the accurate calibration factor. To find the calibration factor, we took the data for two hours each at the ground and at the roof of the building in the fair weather condition. We define the fair weather condition by maximum 3 knots wind speed, 3 octa maximum upper cirrus clouds and no cumulonimbus cloud visible in the sky from the observational site. The confirmation of fair weather condition is done by using the India Meteorological Department (IMD) weather data and also Indian Space Research Organization (ISRO) weather station data available for this region. Furthermore, the value of the average electric field of around 80 $V.m^{-1}$ at the ground level was well comparable with the data in the fair weather condition reported in earlier studies indicates the proper functioning of the EFM at the observational site. The average value of the electric field at the roof was 500 $V.m^{-1}$ during in the same fair weather condition. So the calculated calibration factor was calculated to be 6.25. The maximum electric field that could be measured by the BOLTEK EFM 100 was $\pm$ 20 $kV.m^{-1}$. But due to the experimental limitations, we could observe the maximum field variation of $\pm$ 3.2 $kV.m^{-1}$.

4. Observational results:

Surface measurement of the Vertical Electric Field (VEF) is being continued at the Department of Physics, Tripura University, form May 2009, till to date. During the observational period, we encountered several thunderstorms over the observational region. For the present analysis, we considered ten strong thunder-active days those were very close to the observational site and visible by necked eye. Taking into consideration, the atmospheric electricity convention, we consider fair weather VEF as vertically downwards and

positive. The complex behavior of VEF during one overhead thunderstorm on 15th March, 2010 is shown in the Fig. 1.
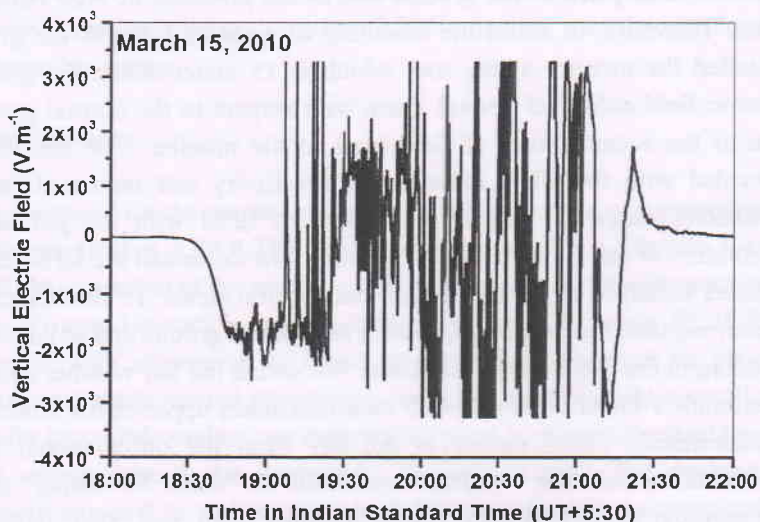
Fig. 1. Typical VEF variation during a period of a total thunderstorm on March 15, 2010.

The cloud activity started at around 18:45 Indian Standard Time (IST) and ended around 21:30 IST. So the total duration of the cloud activity on that day was about 2 hours 45 minutes. The average duration of cloud activity in 10 thunderstorms is found to be around 4.5 hours. The thunderstorms also showed the End of Storm Oscillation (EOSO) at the dissipating phase of the storm in most of the sessions. The electric field monitor became saturated at very high VEF variation during the strong intra cloud (IC) and cloud to ground (CG) lightning flashes for which no counting of lightning strokes were possible. Thunderstorms are generally accompanied by rain. As there was no rain gauge network nearby, we could not measure the amount of rain during the thunderstorm activity. But IMD weather data at Agartala airport situated about 10 km radial distance from the observational site verified the thunder activity and rain over this region qualitatively. However, that data was not sufficient for accurately predicting overhead cloud activity over the observational site. The VEF during the thunderstorm period shows the typical pattern of sudden increases and decreases in the electric field due to both CG and IC lightning discharges and the field returns to the ambient level exponentially after the sudden positive or negative field change. The VEF

variation within a timeframe of 10 minutes from 19:30 IST to 19:40 IST on 15th March, 2010 is depicted in the Fig. 2. The first sudden field change on 15th March 2010 is recorded by the field mill at around 19:05:20 IST whereas the last discharge occurred around 21:14:26 IST.
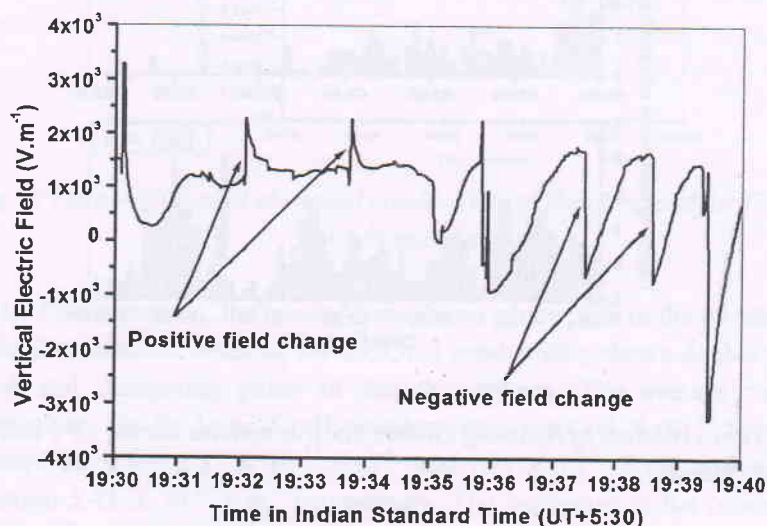
Fig. 2. Typical lightning VEF variation in 10 minute timeframe during a thunderstorm on March 15, 2010.

We observed that a total of 1380 sudden VEF variations occurred in 10 thunderstorms. Out of the total 1380 cases, we found 903 (65.43%) cases of positive and 477 (34.56%) cases of negative VEF variation. We observed 123, 43 and 37 positive VEF variations at the innitial, middle and dissipating phases for Gr I thunderstorms while 34,42 and 24 negative VEF variations at the innitial, middle and dissipating phases respectively for the Gr I thunderstorms occurred in forenoon sessions. It shows that 60.5% of total positive VEF variation occurred in the forenoon session occurred in the innitial phase. However, 241, 250 and 209 positive VEF variations and 111,141 and 125 negative VEF variation occurred in innitial, middle and dissipating phases respectively for the Gr II thunderstorms in afternoon session. We subdivided the 10 thunderstorms into two groups Gr-I (occurred in the local forenoon session) and Gr-II (occurred in the local afternoon session) according to the count rate variation of VEF with time evolution of thunderstorm. Out of the 10 thunderstorms, 3 occurred in the morning and 7

occurred during the afternoon session. Fig. 3 shows the average time evolution of count rate per 5 minute for the Gr-I & Gr–II thunderstorm.
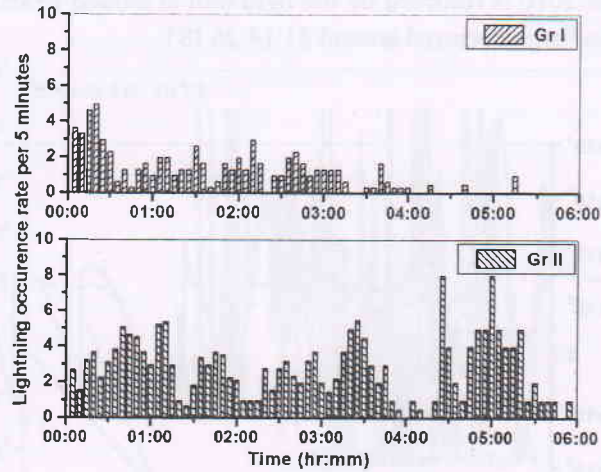
Fig. 3. Time evolution of lightning strokes per five minutes during Gr I and Gr II thunderstorms.

For the Gr-I thunderstorms, the field variation occurred mostly in the initial phase but for Gr II, the distribution shows multiple peak at different phases. The average count rate for Gr I and Gr II thunderstorms are 7 counts per 30 minute and 16 counts per 30 minute respectively. We computed the electrical conductivity from the relaxation time of the individual sudden VEF variation during the thunderstorm period. All the 1380 VEF variations were analyzed in terms of their post discharge relaxation time of the conductive medium which is defined as $\tau = \varepsilon_0 \sigma^{-1}$, where ε_0 is the permitivity of the free space and σ is the electrical conductivity of the cloud in which the lightning occurred. The relaxation time of each sudden VEF change is calculated from e^{-1} times of the maximum VEF change. The conductivity variation within the Gr I and Gr II thunderstorm depicted in the Fig. 4.

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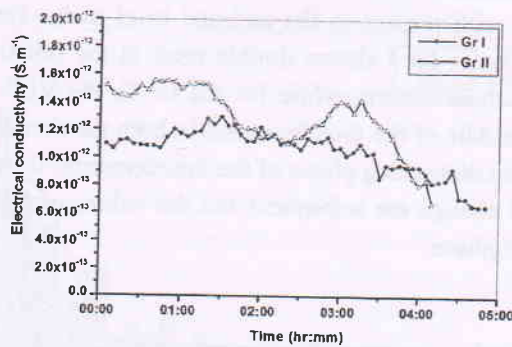
Fig. 4. Time evolution of electrical conductivity of thundercloud for Gr I and Gr II thunderstorms.

For Gr I thunderstorm, the conductivity shows single peak in the middle phase of the thunderstorm whereas, for the Gr II conductivity shows double peak in initial and dissipating phase of the thundrstorm. The average value of conductivity for Gr I and Gr II thunderstorms are 1.08×10^{-12} S.m^{-1} with standard deviation 2.57×10^{-13} S.m^{-1} and 1.29×10^{-12} S.m^{-1} with standard deviation 5.43×10^{-13} S.m^{-1} respectively. The histogram of the conductivity variation for both types of thunderstorm is shown in the Fig. 5. From the Gausian fit of the histogram of conductivity variation for both types of the thunderstorm, we find the most conductivity change occurred at the value 9.30×10^{-13} S.m^{-1} for Gr I and 1.08×10^{-12} S.m^{-1} for Gr II respectively.
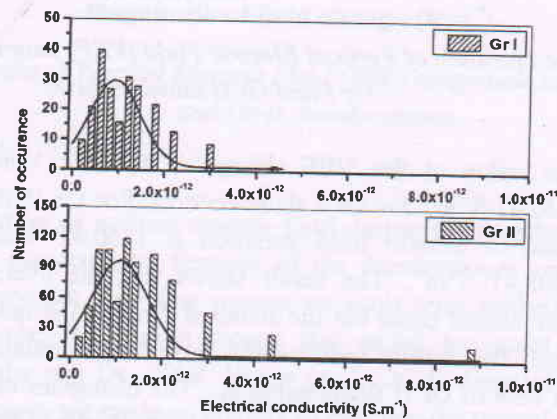
Fig. 5. Histogram of electrical conductivity for Gr I and Gr II thunderstorms.

Fig. 6 shows the typical time evolution variation of the change in the magnitude of the VEF for both types of the thunderstorms. The VEF change in

each event calculated from the difference of the maximum positive or negative VEF change with respect to the ambient level of the field at that time. The VEF variation for Gr I shows double peak at the initial and the dissipating phase of the thunderstorm while for the Gr II, the VEF change show single peak at the middle of the thunderstorm. In both the thunderstorm (Gr I and Gr II), during the dissipating phase of the thunderstorm, the numbers of counts of electric field change are infrequent but the values of VEF changes are quite higher in that phase.
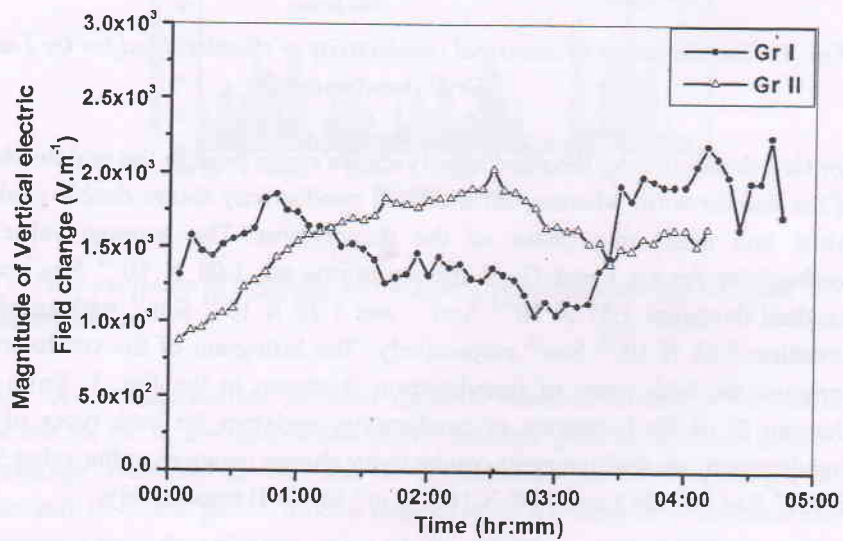
Fig. 6. Time evolution of Vertical Electric Field (VEF) magnitude change for Gr I and Gr II thunderstorms.

The average value of the VEF change is 1536.42 V.m^{-1} with standard deviation 540.41 V.m^{-1} for Gr I thunderstorm. For Gr II thunderstorms, the average value of electric field variation is 1560.42 V.m^{-1} with standard deviation 908.41 V.m^{-1}. The result shows that the average electric field variations are almost equal but the standard deviation is quite higher in Gr II thunderstorm. The results indicate the large scale variability of the VEF variation in case of Gr II thunderstorms. The histogram of the electric field variation for Gr I and Gr II of thunderstorms are shown in the Fig. 7. From the Gausian fit analysis of the histogram of electric field for the thunderstorms, we find the most VEF change occurred at value 744.85 V.m^{-1} and Gr I and 912.72 V.m^{-1} for Gr I and Gr II thunderstorms respectively.
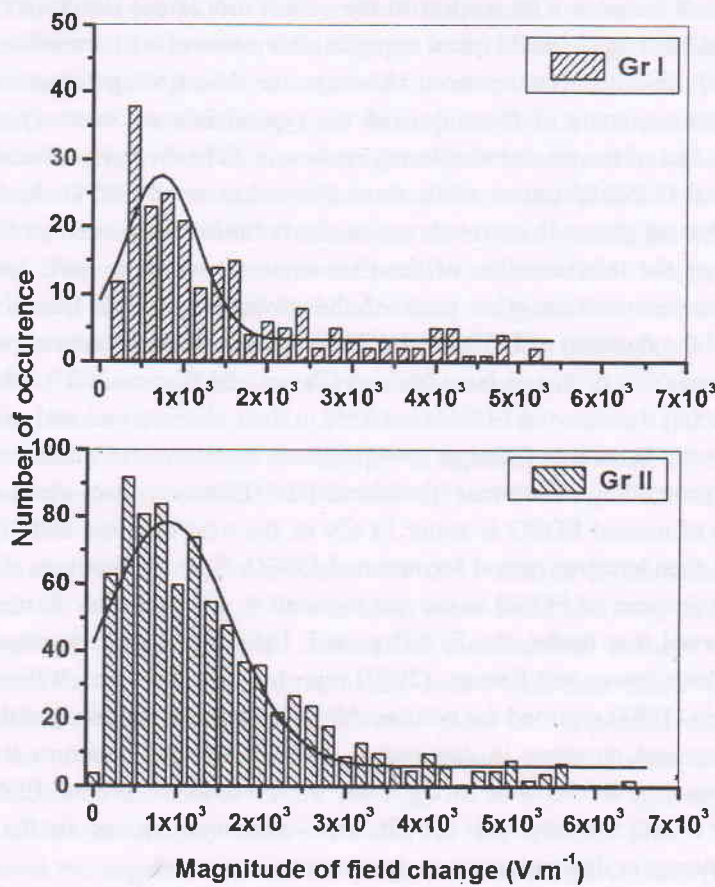
Fig. 7. Histogram of Vertical Electric Field (VEF) magnitude change for Gr I and Gr II thunderstorms.

5. Discussion:

The time evolution of surface electric field during the thunderstorms period revealed some characteristic features of the thunderclouds over North-East India. We observed a very few reports on short term analysis of lightning characteristics over this region though this region has great topographical importance (Guha and De, 2009, Pawar et al., 2010, Gopalakrishnan et al., 2011). In this paper, we made an attempt to examine the typical characteristics of the VEF variation during thunderstorm activity over the region on the basis of longer duration of experimental data. During the period of June, 2009 to June, 2010, we considered ten thunderstorms out of several ones for analysis,

which were very close to the observatory. Thus the thundercloud was beyond the reversal distance with respect to the observational site (Eack, 2004). All the thunderstorms showed typical complex characters of VEF variation during the total thunderstorm period. During the dissipating stage of the thunderstorms, some of them showed the typical End of Storm Oscillation (EOSO). Out of the ten thunderstorms session in different days, seven showed the typical EOSO character while three showed inverted EOSO character in the dissipating phase. In our observation, the duration of the average EOSO is 15.85% of the total duration of the thunderstorm, which is quite lower for other thunderstorms in other parts of the globe. Pawar and Kamra (2007) observed the duration of EOSO to be 24% of the total thunderstorm period in Florida and 55% of that in New Maxico (Pawar and Kamra, 2007). They also reported that the inverted EOSO character in their observations and explained the character in terms of charge transportation of convective mechanism and charge generation in normal thunderclouds. However, we observed the duration of normal EOSO is about 11.6% of the total duration and 20.1% of the total thunderstorm period for inverted EOSO. Such observation about the different features of EOSO is not yet reported in the literature. Furthermore, we observed that during the EOSO period, lightning flashes decreases very much which Pawar and Kamra (2007) reported in their paper. Williams and Boccippio (1993) reported the relationship of vertical air motion and the large scale electrical structure in dissipating stage of the thunderstorm from the observations of EOSO. But in our case, the presence of normal EOSO and inverted EOSO indicates that the electrical structures are not similar for all thunderstorms in this region.

Earlier studies showed that the environmental wind shear structure plays an imperative role in the severity of resulting convection (Paterson et al., 2005). Superposition of all favorable upper and lower conditions due to pressure trough, low pressure areas and the wind convergence causes the outburst of severe thunderstorms (Kotroni et al., 1997). The VEF changes induced by lightning as shown in the Fig. 2 clearly indicate the removal of positive and negative charges from the overhead cumulonimbus clouds and the recovery curves of electric field clearly indicate the return of the electric field to ambient positive and negative charge structure in the thunderclouds. Due to our experimental limitations, we observed the field change up to 3.2 $kV.m^{-1}$. However, the changes in electric field during thunderstorms are found to be up to several $kV.m^{-1}$ at different heights. It should be mentioned that the electrical properties of thunderclouds are highly related to size, horizontal and vertical

extent of the cloud of the observational site (Sinkevich et al., 2009). In our observation, we found that with respect to the total number of field changes, 66% of the total are positive field changes and 34% are negative field changes. It indicates that the tripole structures of thunderclouds are mainly prevailing during the total thunderstorms over this region. For Gr I thunderstorms, 60.5 % of total positive field change during the Gr I thunderstorms occurred in the initial phase which is quite higher than the other phases but for Gr II thunderstorms electric field changes are distributed during the whole storm lifetime. The maximum presence of positive electric field changes produced by lightning in the both type of thunderstorms suggests the presence of strong lower positive charge centers (LPCC) in the cloud (Baranski et al., 2006). However, some observations suggest that strong LPCC may reduce the negative leaders (Pawar et al., 2010). Kamra and Pawar, (2007) already reported the almost uniform distribution of lightning for a hail storm occurred in the afternoon session (1535 LT to 1700 LT) on 31 May, 2002.

In our observation, the count rates for Gr I and Gr-II thunderstorms are different as shown in Fig. 3. We believe, more detail and long term analyses are required for exploring the anomalous electric field changes during the thunderstorm at various time, in a day over North-East India. Convective available potential energy (CAPE) also plays an important role for the initiation of the high flash rate beneath a thunderstorm (Pawar et al, 2010). They indicated the role of CAPE for high occurrences of lightning jump in spite of nonoccurrence severe weather at the ground level. They also suggested the important role of the lower positive charge centers (LPCC) for initiation of lightning flashes at different phases of thunderstorms. We also suggest from our observation that the tripole charge structure and the LPCC seem to be much dynamic over North-East India. Williams et al. (1999) observed the systemic characteristics of severe thunderstorm and rapid increase of lightning activity. Kaltenbock et al. (2009) reported high CG lightning flashes from clustered thunderstorm systems which also support our idea.

Direct measurements of cloud electrical conductivity are very few and the results are inconclusive and contradictory. The electrical conductivity of the air at sea level is around 10^{-14} S.m^{-1}, and it increases rapidly with altitude (Pawar et al., 2009). The electrical conductivity in the fair weather is highly correlated with small ions having sizes of few nanometers and indicates the level of atmospheric pollution and aerosol concentration (Brazenor and

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Harrison, 2005). Observations of electrical conductivity inside the clouds are important for the understanding of cloud electrification processes and the microphysics of the cloud. Balloon borne measurements inside the growing clouds indicate larger values for cloud electrical conductivity than the surrounding clear air (Raj et al., 1993). In this regard, the post discharge relaxation time might be highly useful use to find the electrical conductivity of the thundercloud medium variation after a lightning discharge. In our measurements, we observed that the cloud electrical conductivity increases during the growing stage and shows peak at the middle phase of the thunderstorm then again decreases for Gr I thunderstorms. For Gr II thunderstorms, conductivity profile show multiple peaks at the growing and the dissipating stage of the thunderstorms as shown in the Fig. 3. The conductivity decreases in the dissipating phase of the thunderstorms for both (Gr I and Gr II) thunderstorms. Guha and De (2009) observed the cloud conductivity as 8.12×10^{-10} S.m^{-1} using the relaxation time analysis of the electromagnetic spectrum during tropical summer thunderstorms locally known as "Nor-wester" at North East India. Raj et al. (1993) also reported the variation of electrical conductivity at different phases of a thunderstorm. The value of the electrical conductivity is of the order of 10^{-12} S.m^{-1} for warm clouds. They explained the variation of electrical conductivity in terms of vertical mixing in clouds and the charge separation mechanism inside the thunderclouds.

Lightning flashes produce rapid electric field changes associated with the neutralization of charge while the ongoing charging processes inside structure of the cloud serve to restore and perhaps even to increase further the electric field magnitude. Multilevel measurement of electric field shows a wide range of electric field variation in different methods. Marshall et al. (1989) observed the peak magnitudes of the electric field were 70 and 90 kV.m^{-1}, respectively in the anvil of two thunderstorms in New Mexico. According to Imyanitov et al. (1971), the average dimensions of cloud regions containing the largest charges in active thunderstorms are of the order of a few hundred meters. Further, the strong field regions must be short lived, disappearing once they give rise to electrical breakdown. Therefore, the chances of detecting such regions in thunderclouds using balloons, rockets or aircraft are very difficult. Due to the experimental limitations, we are able to measure the electrical field variation up to $\pm$ 3.2 kVm^{-1}. Within this limits, the time evolution of the electric field change during the thunderstorm is shown in the Fig. 5. For Gr I thunderstorms the electric field variation show multiple peak at the initial

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phase and at the dissipating phase of the thunderstorms with values 1.8 kV.m^{-1} and 2.1 kV.m^{-1} respectively and minimum at the middle phase with value 1 kV.m^{-1}. But for the Gr II thunderstorms we observed single peak at the middle phase with value 2 kV.m^{-1} and minimum at the initial phase with value 0.8 kV.m^{-1} respectively. The electric field variation for the Gr I thunderstorm is quite unusual and need more long term analysis. It may be due to the strong LPCC formation in the initial phase of the thunderstorms for Gr I occurred in the forenoon session. The electric field variation for Gr II thunderstorms is quite general with the growing up of the convective activity in the cloud at the mature stage and then dissipating with time.

It is interesting to mention that the pattern of the electric field variations and the conductivity for the Gr I and Gr II thunderstorms are having some inverse relation with respect to each other. It could be due to the fact that for larger electric field variation needs larger time to return to ambient level. But the correlation factor is around -0.49 for Gr I thunderstorms and -0.24 for Gr II thunderstorms respectively. So the relation does not give any straight forward result and needs to be investigated more in detail. However, only one point measurement of VEF at the surface level is not sufficient to make the conclusion about the exact charge structure of the thundercloud of any location

6. Concluding remarks:

The explanations in the literature about the electric field variation beneath the thunderstorm are very inconclusive and contradictory. That is why more experiments for the proper explanation are highly required using more experimental data. The total charge distribution inside thundercloud is quite complex and cannot be completely defined from the surface electric field measurements alone. RADAR observations and Radio-sonde observations are highly required to generalize the characteristics of severe thunderstorms. Present observation indicates the importance of regional topology on the characteristics of severe thunderstorms. We however, certainly tried to bring out some characteristics electrical behavior of thunderclouds over North-East India, which needs to be confirmed from more long term networked observations for proper scientific understanding of the collected data.

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Optimization of (M/M/s) model: A Case Study to Restaurant Queuing System

Dr. Runu Dhar*

Abstract

The main objective of this paper is to investigate the optimality of (M/M/s) : (∞/FCFS) [Poisson arrival, Poisson departure, the number of service stations is s in parallel, infinite capacity and " First Come, First Served"] queuing model in queuing system of restaurant model. Here we study different queuing models on the restaurant systems in order to provide better service to the customers and find the waiting times, queue length. Queuing analysis and queuing theory will be investigated and applied to optimize the waiting time and to improve customers satisfaction. In order to find the optimum solution, we will apply queuing model, namely, the (M/M/1) : (∞/FCFS) [Poisson arrival, Poisson departure, single server, infinite capacity and " First Come, First Served"] first to the data obtained from restaurant and find waiting time, length of queue(s) and utilization factor. After analyzing the so obtained results, it will be shown that the service facility to the customers of the concerned restaurant is not adequate to fulfill its needs. Then we will study the (M/M/s) : (∞/FCFS) queuing model for the same data to obtain the same results. After analyzing so obtained results, it will be shown that (M/M/s) : (∞/FCFS) model will provide optimum service to the restaurant customers.

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1. Introduction:

The importance of queuing theory is found in modern day society. It appears in various fields from telecommunications to normal queuing at restaurant, Railway counters, ration shops, doctor chamber, banks and much more. The

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queue in a system is formed if the number of arrivals to a system exceed the number of requests the system can provide service per unit of time. Thus a system is said to contain a queue when it is congested. In this paper we investigate the optimality of (M/M/s) : (∞/FCFS) queuing model and applying it to the system of a restaurant will be addressed. Nowadays in modern public life restaurant units are considered as one of the most necessary and important units. Arrivals to the system of restaurant firm is customers. The system of the restaurant is to be investigated to provide better service to the customers and to minimize time which is needed to provide service. Here we focus to analyze the queues to optimize services of the restaurant to the customers and to reduce customers waiting time and increase service satisfaction.

The main research objective is to show that the time spent at restaurant could be improved if a queuing system can be applied judicially. The three important elements in queuing theory are arrival rate, service rte and utilization factor '(Allen, 1980)' and '(Gross, 2008)'. In the restaurant models, the arrival rate means the number of customers who arrive at restaurant in each unit time. The service rate is the number of customers that is serviced in each unit time, the utilization factor means efficiency related to work performed by the restaurant system or in other words the arrivals divided by departures or serviced clients '(Blanchard and Fabrycky, 1990)' and '(Bolch, Greiner, Meer and Trivedi, 0206)'. The system will not be effective when the utilization factor is more than one, since a utilization factor more than one indicates that the number of customers who arrive is greater than that of serviced in each unit time. When implementing queuing theory to an intelligent manner waiting times will be reduced and customers satisfaction will be improved '(Ndukwe, Omale and Opanuga, 2011)'. Here we have to structure as follows. In section 2, some basic definitions are to be mentioned. An overview of existing research is to be given in section 3. Section 4 narrates the field work of the problem. In section 5, the flow of customers to the restaurant and customers being served by the counters are given. Section 6 outlines the graphical representation of the performance of counters and calculation of different results are also shown. Obtained results would be discussed in section 7. Lastly in section 8, conclusions from obtained results are to be outlined.

2. **Preliminaries:**
In this section some basic definitions and characteristics of queuing theory will be mentioned.

Queuing Model: A suitable model which is used to express a service based problem. In this case customers can arrive randomly to receive service.

Arrival: Arrival can be represented by the probability distribution of arrivals in an interval.

Service Time: It is the time required by a server to provide service.

Server: Service is provided by the server.

Queue Discipline: It means an order where the customers of the queue are offered service.

Poisson Process: It is a probability distribution where the number of arrivals in an interval of length t follows a Poisson distribution with parameter xt, where x denotes rate of arrival.

Queue: A queue is a line where customers are waiting to receive service, including those who already been served.

Queue length: It means the number of customers at any time in the system.

Average length of line: It is the number of persons per unit of time in the queue.

Waiting time in queue: It is the time taken by a customer before being served in the queue.

Waiting time in the system: It is the total time spent by a customer in the system.

Waiting time in the system = service time + waiting time in queue

Average idle time: The average idle time is the time when the system remains idle.

FIFO: It means first in first out queue discipline.

Bulk Arrivals: If more than one customer enter the system at an arrival event, it is known as bulk arrivals.

Components of queuing system:

Input source: The input source generates customers for the service mechanism. The most important characteristic of the input source is its size. It may be either finite or infinite.

Queue: It is characterized by the maximum permissible number of units that it can contain. Queues may be infinite or finite.

Service discipline: It refers to the order in which members of the queue are selected for service. Frequently, the discipline is first come, first served.

Service mechanism: It includes a description of time to complete service and the number of customers who are satisfied at each service event. The service mechanism also describes the number and configuration of servers. The unit

enters at a given facility, one of the parallel service channels and is completely provided by that server.

Customer's Behaviour:

Balking: A customer may not like to join the queue due to long waiting line.
Reneging: A customer may leave the queue after waiting for some time due to impatience.
Collusion: Several customers may cooperate and only one of them may stand in the queue.
Jockeying: When there are a number of queues, a customer may move from one queue to another in hope of receiving the service quickly.
Server's Behaviour
Failure: The service may be interrupted due to failure of a server (machinery).
Changing service rates: A server may speed up or slow down, depending on the number of customers in the queue. For example, when the queue is long a server may speed up in response to the pressure. On the contrary, it may slow down if the queue is very small.
Batch processing: A server may service several customers simultaneously, a phenomenon known as batch processing.

3. **Existing research:**

In developed economy, the concept of queue is a known issue. It is fact that there is hardly any person in the world who had not spent some part of waiting in the line for some kind of service. A frustration due to wait in line must occur. It is often occur in everyday life when people are in line at the at the doctors chamber, Railway ticket counter, the ration shop, the big bazar or in the banking hall or ATM booths. The formal study of waiting in line is found in queuing theory which also includes the study of operations management as a whole. This paper will investigate the role of queuing models in restaurant systems to provide better service to the customers. In restaurants, this theory can be applied to measure multiple factors, namely arrival and waiting time of customers, queuing length, service time, arrival rate, service rate, utilization factor,etc. Application of this theory would be used in restaurants with large number of customers where multiple service points provide service to the customers.

QMS with better performance refers to the using a remote and local service '(Bagchi, 2015)'. M/M/1 queue model can simply the modeling process

'(Mahmood, Chilwan, Sterb and Jarschel, 2015)'. It is fact that a negative impact due to queuing delay may occur on the efficiency of a system '(Al-Mogren, Iftikhar, Imran, Xiong and Guizani, 2015)'. Thus different servicing models may introduce into the system to assess performance improvements. Besides these, many other researchers '(A. Sarkar, A. R. Mukhopadhyay, and S. K. Ghosh, 2011)', '(Madadi, Roudsari, Wong and Galankashi, 2013)' and '(Xiao and Zhang, 2010)' investigated on queuing theory to improve service quality, efficiency of tellers, the service time, the queue length and waiting time of the banking scenario. After getting motivation from these works, we are interested to introduce queuing models in restaurant sector to provide better service to the customers.

4. Field Research:

Here we applied quantitative research method and collected the data as per the daily record of flow of customers through queuing system over a week of a Restaurant. We analyzed different queuing models and techniques and established a suitable model to provide better service to the customers. The suitable model will estimate the actual time to improve service to the customers.

5. Performance of counters:

Each of Table 1 to Table 5 show the records of flow of customers from Monday to Friday to the restaurant and being served through counter 1, counter 2, counter 3and counter 4 per hour.

Table 1: Performance of Counter 1 to Counter 4 on Monday

Time	Counter 1 Customers		Counter 2 Customers		Counter 3 Customers		Counter 4 Customers	
	Arriving	Served	Arriving	Served	Arriving	Served	Arriving	Served
11 AM – 12 Noon	26	23	31	28	18	13	27	26
12 Noon – 1 PM	27	23	21	20	22	21	26	23
1 PM – 2 PM	17	16	18	15	28	24	17	13
2 PM – 3 PM	19	14	13	11	13	8	29	24
3 PM – 4 PM	21	15	20	16	17	11	10	7
4 PM – 5 PM	16	15	21	20	11	7	17	13

Table 2: Performance of Counter 1 to Counter 4 on Tuesday

Time	Counter 1		Counter 2		Counter 3		Counter 4	
	Customers		Customers		Customers		Customers	
	Arriving	Served	Arriving	Served	Arriving	Served	Arriving	Served
11 AM – 12 Noon	28	24	25	20	18	11	22	18
12 Noon – 1 PM	22	13	31	25	14	8	10	7
1 PM – 2 PM	29	24	19	15	26	24	19	15
2 PM – 3 PM	22	22	30	21	25	20	23	19
3 PM – 4 PM	27	23	19	14	36	25	17	13
4 PM – 5 PM	24	22	20	20	30	27	18	12

Table 3: Performance of Counter 1 to Counter 4 on Wednesday

Time	Counter 1		Counter 2		Counter 3		Counter 4	
	Customers		Customers		Customers		Customers	
	Arriving	Served	Arriving	Served	Arriving	Served	Arriving	Served
11 AM – 12 Noon	17	16	15	11	12	9	22	19
12 Noon – 1 PM	28	23	25	23	9	5	21	20
1 PM – 2 PM	27	23	21	13	18	15	12	8
2 PM – 3 PM	29	26	21	17	24	13	9	6
3 PM – 4 PM	23	20	19	14	13	12	14	11
4 PM – 5 PM	31	28	29	23	29	24	29	22

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Table 4: Performance of Counter 1 to Counter 4 on Thursday

Time	Counter 1 Customers		Counter 2 Customers		Counter 3 Customers		Counter 4 Customers	
	Arriving	Served	Arriving	Served	Arriving	Served	Arriving	Served
11 AM – 12 Noon	14	8	17	14	19	11	19	14
12 Noon – 1 PM	18	11	25	20	31	23	29	26
1 PM – 2 PM	27	24	31	24	31	25	17	16
2 PM – 3 PM	37	29	36	35	19	14	28	23
3 PM – 4 PM	26	24	19	18	24	24	25	23
4 PM – 5 PM	29	25	31	23	31	23	21	13

Table 5: Performance of Counter 1 to Counter 4 on Friday

Time	Counter 1 Customers		Counter 2 Customers		Counter 3 Customers		Counter 4 Customers	
	Arriving	Served	Arriving	Served	Arriving	Served	Arriving	Served
11 AM – 12 Noon	21	18	28	24	24	21	28	24
12 Noon – 1 PM	14	14	24	23	15	14	13	12
1 PM – 2 PM	26	23	21	17	18	15	17	13
2 PM – 3 PM	19	14	10	7	8	6	28	25
3 PM – 4 PM	27	24	29	24	22	19	26	22
4 PM – 5 PM	31	23	23	18	28	23	29	23

Table 6: Analysis of the machines performance (independently)

Day		Counter 1 Customers		Counter 2 Customers		Counter 3 Customers		Counter 4 Customers	
		Arriving	Served	Served	Arriving	Arriving	Served	Arriving	Served
Day 1	Total	126	106	110	124	109	84	126	106
	Average	21	17.66667	18.33333	20.66667	18.166667	14.0000	21.00000	17.66667
Day 2	Total	152	128	115	144	149	115	109	84
	Average	25.33333	21.33333	19.16667	24	24.833333	19.166667	18.15333	14
Day 3	Total	155	136	101	120	105	78	107	86
	Average	25.833333	22.66667	16.833333	20	17.50000	13	17.83333	14.33333
Day 4	Total	151	121	134	159	155	120	129	115
	Average	25.166667	20.16666	22.33333	26.5	25.833333	20	21.5	19.16666
Day 5	Total	138	116	113	135	115	98	141	119
	Average	23	19.3333	18.83333	22.5	19.166667	16.33333	23.5	19.83333

6. **Performance of servers shown graphically:**

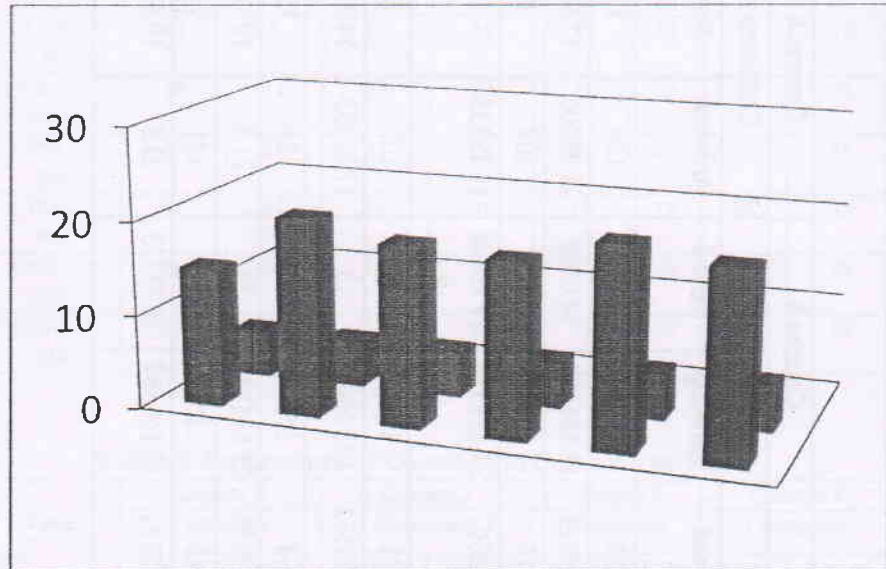Data is shown graphically from Figure 1 to Figure 4 (for the different counters)
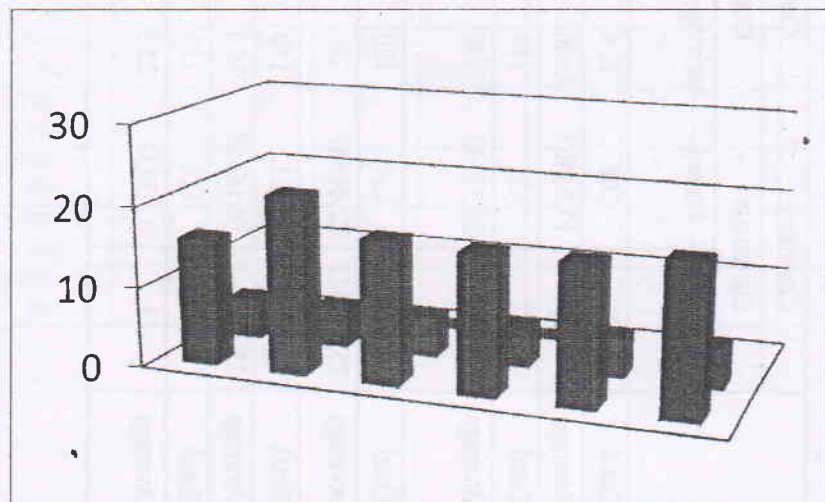

Figure 1. Performance of Counter 1
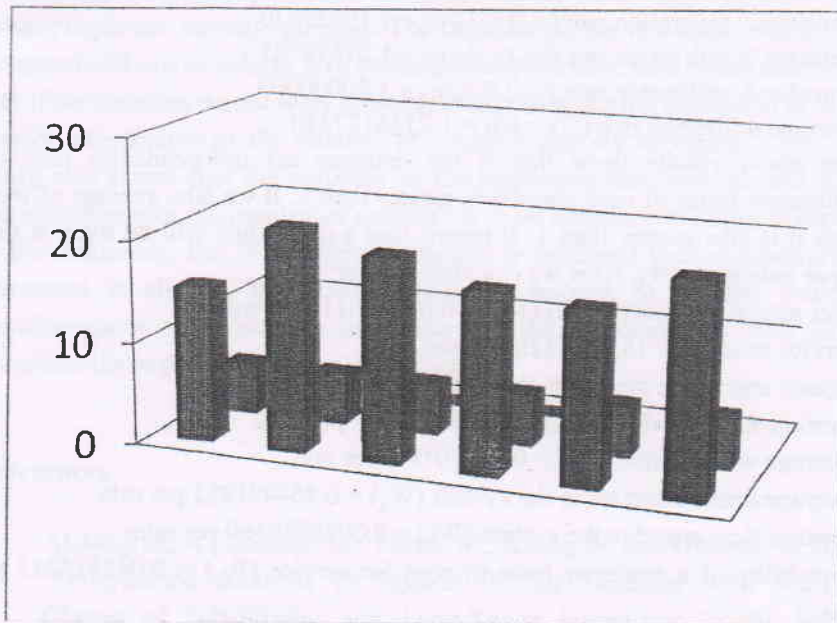

Figure 2. Performance of Counter 2

Figure 3. Performance of Counter 3
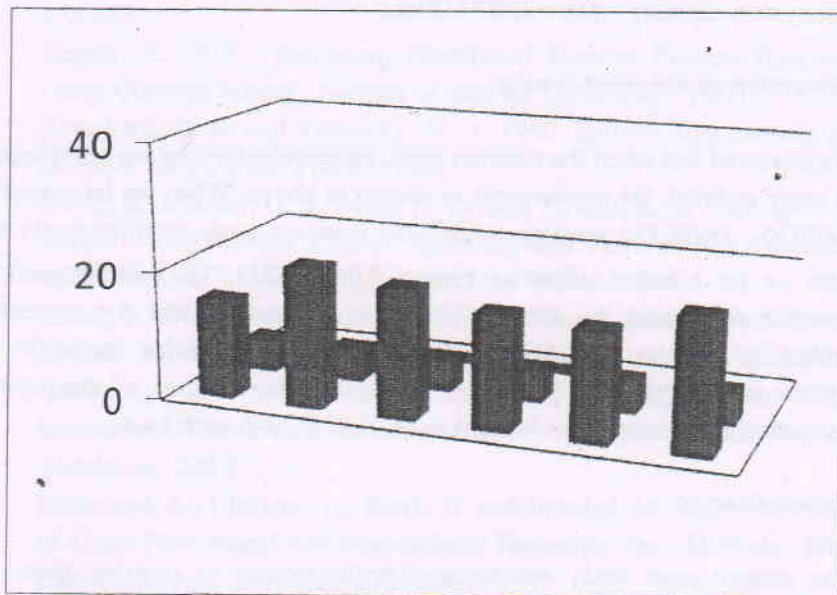
Figure 4. Performance of Counter 4

Calculations:

Counter 1: utilization rate $(\rho_1) = \lambda_1/\mu_1 = 1.18945636$

Counter 2: utilization rate $(\rho_2) = \lambda_2/\mu_2 = 1.19022670$

Counter 3: utilization rate $(\rho_3) = \lambda_3/\mu_3 = 1.27878787$

Counter 4: utilization rate $(\rho_3) = \lambda_4/\mu_4 = 1.20000000$

Average utilization rate $(\rho) = \lambda/\mu = 1.2146177330$

The above results show that if the counters act independently then the utilization factor of each counter is greater than 1. If we take average of these then it is also greater than 1. It means that a queue line will be there if they serve independently. Now we calculate further:

Inter arrival time (expected) $(1/\lambda) = 0.045300114$ per min.

Service time $(\mu) = 18.2083325$ per min.

P_0(zero unit in the system)$= 0.26895918$per min.

Average number of line $= L_q = 0.210415384$ per min.

Average waiting time $(W_a) = 0.01970199$ per min.

Average time customers in the system $(W_q) = 0.464491952$ per min

Average time spend in the system $(W_S) = 0.0020938160$ per min.

Probability of a customer have to wait for service $(P_w) = 0.042416213$ per min.

Customers (in average) in the system $(L_s) = 0.17323563$

System utilization $(\rho) = \lambda/M\mu = 0.303089248$,

The system capacity $= M\mu = 72.833333$sec.

7. Discussion on obtained results:

We observed that when the counters work independently they are not adequate to serve as much the requirement as shown in above. When we have applied $(M/M/s) : (\infty/FCFS)$ queuing model, the counters work simultaneously and then we get a better utilization rate of 0.042416213. The parallel work of counters minimizes the time to wait for a customer and the respective probability reduces to 0.002093816 per min. The utilization factor for the system is 0.303089248 per hour. Moreover the capacity of the system consisting four counters is obtained to be 72.833333 in each hour.

8. Conclusion:

The present case study concludes that the notion of queuing theory is necessary to an organization for the betterment of the concerning company. We have conducted the research at a local restaurant in Agartala, Tripura.

There are randompeople coming to the Restaurant in different hours. We assume that potential customers will start to balk when they see more than usual people are already queuing. The capacity of the restaurant when fully occupied will not be able to give better service. We have seen in the case study that if the counters do not work simultaneously they are not enough to give the service irrespective of the number of counters that are servicing. The case study also shows that the counters of the respective restaurant should work simultaneously or the number of counters is to be increased to improve service to the customers. But if number of counters is increased then expenditure of restaurant is also to be increased. So we suggest to act the counters simultaneously to reduce waiting time for the customers as well as to minimize the expenditure of the restaurant.

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Selecting a New Site for University Library Building with Eco-Friendly Initiative:
A Proposal for Developing a New Central Library Building of MBB University, Agartala

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Abstract

Adoption of eco-friendly technologies is the only solution to survive humanity. In recent years, many countries' organizations/ institutions are developing new technologies to save our nature by paying a nominal cost. Moreover, the computer industry has also realized that going with eco-friendly technology is in their best interest regarding public relations and costs effectiveness. Due to the advancement of Information and Communication Technology, Library and information services have been adopting advanced technology to cater the need to ardent information users. Therefore, the Libraries are trying to adopt new eco-friendly technologies for developing university library building.

When there is a need to build new buildings especially Library Building, precautions must be taken before selecting the site of the building or library building. The choice of a good site will be the cost effective and will save the nature to a greater extent.

This paper discusses the various factors which may be taken care into consideration before selecting of the site for the Library Building. Further, challenges related to choosing the area for the new Library have also been discussed. Lastly, suggestions related to selecting the library site of Maharaja Bir Bikram University, Agartala is proposed without disturbing the current structures of university buildings.

Keywords: Site-Selection, Eco-friendly Library, Sustainable Library.

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1. Introduction

Nowadays, the organization has started re-thinking the various survival issues and up-coming challenges for environmental sustainability. Since Library is also a part of an academicorganization and a service oriental institution; it can easily take care of various eco-friendliness in its day to day activities. The Green Library is an entity designed to reduce the natural environment's adverse effects and increase internal environmental quality through deliberate site selection, natural building materials and biodegradable products, conservation of resources, and responsible waste disposal or recycling (Reitz, 2014). Sustainability in general and environmental sustainability, in particular, is commonand very prominent features. "Sustainability is widely considered an important part of contemporary life." (Loh. 2005).

The location of the site may also have a significant impact on the environment. The selection of the site for any Library should reflect the particular needs of the people of that place. An important consideration is the building's location concerning the services will need to access by all. Dr. S. R. Ranganathan had stated this concept for more than six decades. Winston Churchill also mentioned as "*we shape our buildings, and after that, they shape us,*" libraries serve as symbols of the values and attitudes of their creators. It can help to extend those values and attitudes to future generations of visitors and occupants. To build a new library or update an existing library, sustainable design measures should be prioritized flexibly to changing functional demands. It also provides an inspiring and safe envirinment to perform efficiently, providing significant financial value to the people.

2. Environment and Site Selection for Library:

John Elkington writes that "*Society depends on the economy - and the economy depends on the global ecosystem, whose health represents the ultimate bottom line. The three lines are not stable; they are in constant flux, due to social, political, economic, and environmental pressures, cycles, and conflicts.*" *(Mendler and Odell, 2000).*

Importantly, site selection for the new library building has substantial impact on how Library is going to be eco-friendly. Based on appropriate guidelines, proper consideration should be given to the construction process and its effects on ecological surroundings. Erosion, population density, accessibility via public transportation, and construction materials are essential in putting up a green library building. For the newly established Library, it is necessary to select the site before design the library building.

Generally, a site near a lake or river is suitable, which will keep the library environment naturally cold. It will also ensure the conservation of water resources. A well-selected site can facilitate strategies to capture rain water runoff, which will then be used in irrigation or cleaning purposes. Further, the Library must be placed at the center of all departments of the institute so that students and faculty members can access it very quickly. Therefore, it is essential properly to select the site for a newly established institution. So, there should be a

proper guideline for choosing the institution's location and especially for the institutional Library.

3.   About Maharaja Bir Bikram University, Agartala:

Maharaja Bir Bikram University, established by an Act of Tripura Legislative Assembly, began its maiden journey in 2015 to encourage imagination, innovations, and ideas in the newly emerging academic disciplines without ignoring the vast knowledge been accumulated over a long period of human civilization. A total number of four Post Graduate courses run under this University. In addition to these, Ph. D programs are also being offered in three subjects. The number of affiliated Colleges under this University at present is three, among which there are two General Degree Colleges and one Professional Degree College, and almost 40% of total Undergraduate students of Tripura belong to these three colleges.

Figure:1 Administration Building, MBB University   Figure:2 Academic Building, MBB University

Maharaja Bir Bikram University, Agartala, has started its beautiful journey with its two significant buildings, operating as Administration Building and Academic Building. But it has yet to get a separate library building of its own. A library with a very good collection is established on the ground floor of the academic building. So, when there is a plan for a separate library building, University may consider various factors for the students, scholars, or faculty members.

4. Review of Literature:

Sustainability in general and environmental sustainability in particular are obviously common and very prominent features. "Sustainability is widely considered an important part of contemporary life." (Karioja & Niemi 2013, 138) Environmental awareness is more than a fashionable label. "It is an ethic that should be embedded deep within the actions and consciousness of any person who truly wishes to lighten the burden on nature, our built world and future generations." (Scherer 2013, 32) Sustainability and going green are a trend which has already reached library architecture and design (Sommer 2013, 1) as well as library management and services. Following the "green library movement" (Antonelli 2008) will

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definitely meet the customers' demands. Therefore "… to create a visible green image for the library is an important part of the environmental work (Sahavirta 2013, 330)" but question arises as can we make plan to develop a new library building with eco-friendly initiative.

5. Proposed Site Selection:

Site selection is the process of examining any site with relative advantages and disadvantages for assessing multiple options. It is a very much important factor when we are dealing with the Library. The selection of sites for the Library directly affects the usage of library materials. Dr. S.R. Ranganathan, stated that the Library should be located in the central position so that each library users must feel comfortable to use the Library. Further, if we want to incorporate the eco-friendly initiative, it may violate some Five Laws of Library Science principle depending on the geographical location.
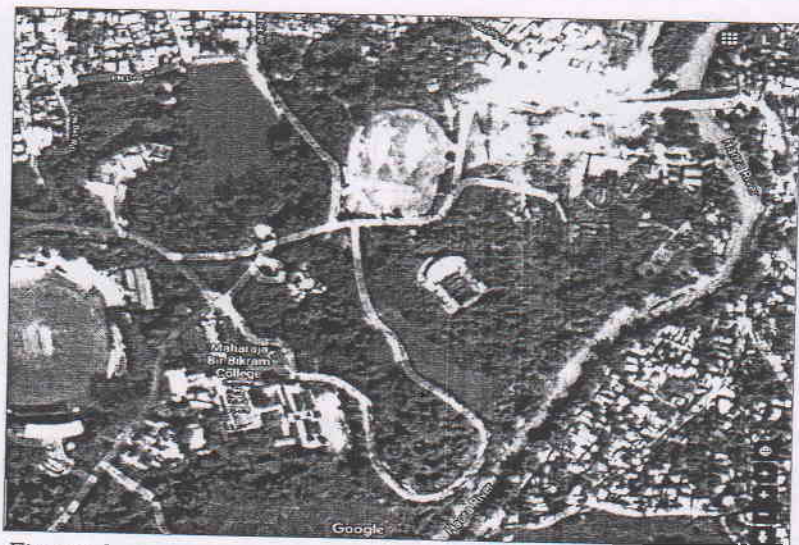
Figure: 3: Satellite view of Maharaja Bir Bikram University Campus

Figure: 3 shows the geographical location of Maharaja Bir Bikram University Campus. On this campus, there are three-degree colleges, which are affiliated under the Maharaja Bir Bikram University. The three degree colleges are, Maharaja Bir Bikram College, Govt. Law College, Bir Bikram Memorial College. Out of which Maharaja Bir Bikram College, is the oldest college in Tripura, which also maintains a separate library building of its own. Thus keeping views of the location of all three colleges and present university buildings, three different sites can be proposed for the university library building as shown in Figure: 4.

Proposed Site-1: This site is very near to the academic building. So, this site would be very much suitable for students and teachersto access the Library. Now, if we check about the eco-friendly initiative parameter, we can quickly identify that a river (known as Howrah River) is passing behind the place (for reference Figure 3). So, it will help to keep the Library

naturally cool by fresh air. Since the chosen location is in the upper part of the hill, so this place will not be affected by flood at any time.
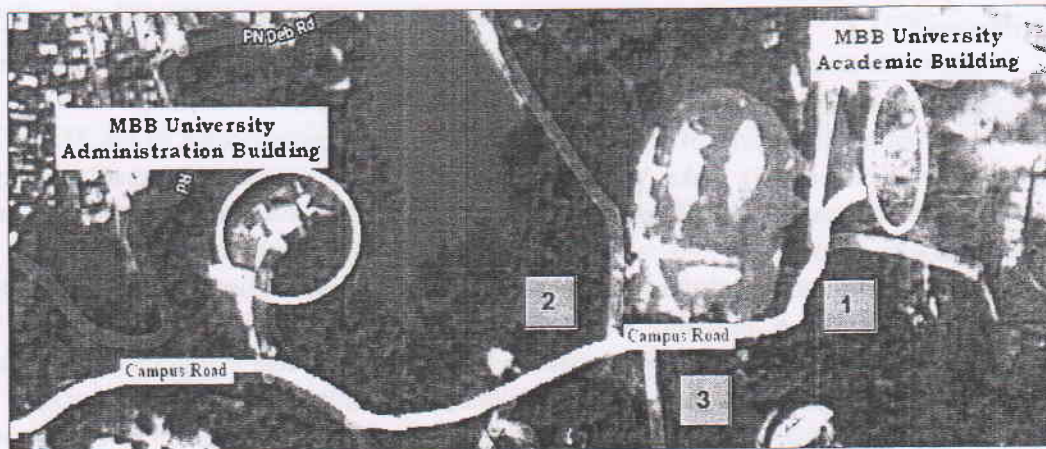
Figure: 4: Proposed site for the University Library Building (Google-map image)

Proposed Site-2: This site is in the middle of the academic building and administration building. So, this site will be very much helpful for students, teachers, and staff members to access the Library. Therefore, there will not be any problem to access by anyone. Now, if we check about the eco-friendly initiative parameter, we can easily identify that a beautiful lake exists just opposite to the location (for reference Figure 4). So, it will also help to keep the Library naturally cool with fresh air. Since this chosen place is also located at the upper part of the hill, this place will not be affected by flood at any time.

Proposed Site-3:

This site is also located in the middle of the academic building and administration building and almost opposite to the proposed site: 2. This site will also help students, teachers, and staff members access the Library. If we check about the eco-friendly initiative parameter, we can identify that the same lake exists just in-front of the site and the river behind. So, it will also help to keep Library naturally cool with fresh air.

6. Discussion and Conclusion:

These proposed sites may be best in terms of library usage patterns or eco-friendly initiatives. The uses of natural resources are the best technique to save our nature. Libraries are irreplaceable organs of communities, and thus, their image in society matters. This can be earned through such small initiatives in library practices. Many techniques are being employed to safeguard the ecological environment with growing concern to build and refurbish libraries according to sustainable or green patterns. The government must look into various such issues before starting the project. It is also true that the construction of a separate library building is a huge cost, but if we want to develop the education system, we have to invest in it. By looking into such issues, we also reduce the cost to some extent. If we

can implement any of these proposals, it can be a role model for all other academic or public Libraries.

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Gender Disparities in Children's Literature with Special Reference to *Tintin in the Congo* and *Harry Potter* Series

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Abstract

Children's Literature is defined as material written and produced for the information or entertainment of children and young adults. Literature, oral or written has always been a powerful medium to initiate children into the ways of the world, both within and beyond the confines of homes. As the child grows up, it recognizes the differences in terms of the literary representations catered through literature. Children perceive the world in terms of gender discrimination based solely on their fixed structures. The world of Children's Literature is vast and rich in itself. But what is striking is the very fact that this apparently so-called innocent world of Children's Literature have racist prejudices as well as gender bias in it. The portrayal of women in children's books are either minimised or sometimes intentional omissions are done. More than the female, it is the male who dominate the genres of Children's Literature as a whole. As a consequence, children tend to project themselves as the protagonists portrayed in these stories thus engendering a sense of bias and discrimination from a very early stage. The main objective of this paper is to find out how gender bias or gender roles or the role of women is depicted through Children's Literature. Further, this paper would also try to look into two very popular genres and select texts of Children's Literature, viz., Picture Books and Fantasy Fiction- Tintin in the Congo and Harry Potter Series.

Keywords: Children, Literature, Women, Gender, Discrimination, Bias, Minimised, Intentional, Male, Picture Books, Comic Strips.

According to Seth Lerer, "Ever since there were children, there has been children's literature"(1). Children's Literature is defined as material written and produced for the information or entertainment of children and young adults. Children's Literature comprises of picture books, easy-to-read stories, fairy tales, lullabies, fables, folk songs and other primarily orally transmitted materials in order to entertain or instruct young people. Children's Literature was first derived from folklore and then passed down from generation to generation. It was only from the mid to late eighteenth century that Children's Literature came to be recognized as a specific and a distinct category.

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The world of Children's Literature is vast and rich in itself. What is striking is the very fact that this apparently so-called innocent world of Children's Literature bear racist prejudices as well as gender bias in it. If we speak about the role of women, it is seen that the former are actually minimised or given no role of importance at all. More than the female, it is the male who dominate the genres of Children's Literature as a whole. Women are either there to help the males or just play as sub-servient to them. The women are made to follow the blind dictates of the society. They are seen as agreeing to everything practically what the male desires. The "she" has no right to say or even dare to go against anyone. She is turned a mere puppet in the hands of the male-dominated society. And these kind of instances largely abound in the colourful world of Children's Literature and its various genres. Shana Meganck in her, *The Portrayal of Female's Images in Children's Literature: An analysis of the prevalence of gender behavior patterns from 2000 to 2010*, is of the view that,

> Although more recent results of studies have revealed that gender differences in Children's Literature have decreased considerably toward more sexual equality, with female representation as main characters becoming proportionate to that of male characters (Kinman and Henderson 1996), there has still been much research in the past showcasing that this has been an issue for years and more needs to be done. In a hallmark study conducted by Weitzman, Eifler, Hokada and Ross in 1972, the researchers examined prize-winning picture books. They found that females were largely underrepresented in the titles, central roles, and illustrations. When females did appear in the books, their characterization reinforced traditional sex-role stereotypes, such as passivity and occupational limitations (Meganck 4-5).

Even the representation of females did not change recently too. Meganck further cites,

> More recently, in 2006, Hamilton, Anderson, Broaddus and Young conducted a twenty-first century update on gender stereotyping and underrepresentation of female characters in 200 popular children's books. The results showed that female characters are still underrepresented in children's picture books. There were nearly twice as many male than female main characters; male characters appeared more often in illustrations; female characters were showcased nurturing and indoors more than male characters; and occupations were gender stereotyped (Meganck 7).

As cited in *The Telegraph*, "Children's books are 'sexist and enforce gender inequality' as kids' books are almost twice as likely to feature a male hero than a female heroine and could be reinforcing gender inequality, new research warns". It is seen that, the discrimination that exists between female and male representation is worse, even more in children's books with animal characters – "often favoured by publishers as 'gender neutral' with male animal heroes featuring in three times more books than female animal heroines" (The Telegraph).

More and more studies increasingly brings to the forefront about the discrimination and the bias that exists in the portrayal of females in Children's Literature. As cited in *The Guardian*, the very popular and the classic children's literature picture books too sends out the message that, "women and girls occupy a less important role in society than men or boys". To further cite, "Looking at almost 6,000 children's books published between 1900 and 2000, the study, led by Janice McCabe, a professor of sociology at Florida State University, found that males are central characters in 57% of children's books published each year, with just 31% having female central characters. Male animals are central characters in 23% of books per year, the study found, while female animals star in only 7.5%...The messages conveyed through representation of males and females in books contribute to children's ideas of what it means to be a boy, girl, man, or woman.

The disparities we find point to the symbolic annihilation of women and girls, and particularly female animals, in 20th century children's literature, suggesting to children that these characters are less important than their male counterparts", write the authors. "The disproportionate numbers of males in central roles may encourage children to accept the invisibility of women and girls and to believe they are less important than men and boys, thereby reinforcing the gender system" (The Guardian "Study finds huge gender imbalance in children's literature").

Fairy tales, which comes under the category of Children's Literature, is also a part of oral storytelling traditon. But this genre is also not free from bias against women. Cecilia L. Ridgeway states, "Gender, like race, is a categorical form of inequality in that it is based on a person's membership in a particular social group or category, in this case, the categories of females and males" (Ridgeway 4). The very popular and the classic fairy tales by Brothers Grimm, Charles Perrault, Hans Christian Andersen's tales etc. contribute to the prevalent bias. Tales such as *Snow White and the Seven Dwarfs, Cinderella, Sleeping Beauty, Beauty and the Beast, The Little Mermaid* etc. all contribute to the male-dominated society. The women are only helpless, passive, weak, submissive or timid while their male counterparts were the ones who would always rescue them from their dangerous or helpless situation and are therefore strong.

Georges Remi or Herge, the creator of *Tintin* Series, was an illustrator for a Belgian newspaper in Brussels. The series has a total of twenty-four books with a publishing history of more than two hundred million copies (Wikipedia "The Adventures of Tintin"). All the books have been translated in various languages around the world and remain popular to this very day.Tintin's adventures transport the readers to various places such as the Land of the Soviets, Congo, America, Tibet, Australia, Europe, The Middle East, Egypt etc. apart from leading him to the moon and the sea as well. Tintin is a young, teenage white reporter who lives in colonial Belgium. He is always accompanied by his dog, Snowy who travels with him on all his adventures. The duo together solves all the mysteries that befall on them.The Foreword to the English-language edition of the text of *Tintin in the Congo* (1931)by Leslie Lonsdale-Cooper and Michael Turner records the publishing details of the book:

> ...*Tintin au Congo* first appeared in June 1930, in "Le Petit Vintieme", the children's supplement to the Brussels newspaper "Le Vingtieme Siecle",

where it was published as a serial over a period of a year. In 1931 the story was published in book form by Les Editions du Petit Vingtieme and a few months later by Editions Casterman of Tournai. The first English language edition, translated by Leslie Lonsdale-Cooper and Michael Turner, was published in 1991 by Sundancer, London. *Tintin in the Congo* featured the full length version of the story with black and white illustrations. In 1946 *Tintin au Congo* was revised by Herge and published in colour by Casterman in the standard 64-page album format. It is from this edition that the present book is translated. In addition, when *Tintin au Congo* was later to be published in translation in Scandinavia, Herge redrew page 56, and the revised version of this page is included here. In his portrayal of the Belgian Congo, the young Herge reflects the colonial attitudes of the time. He himself admitted that he depicted the African people according to the bourgeois, paternalistic stereotypes of the period - an interpretation that some of today's readers may find offensive. The same could be said of his treatment of big-game hunting (Foreword "Tintin in the Congo").

Some of the original illustrations from the 1991 English Language edition of the book, are also featured in the Figures Section of this work. A peek into the illustrations would help to understand how the book promoted racial prejudice. Later on, the comic book was revised and the illustrations, the language were either - changed or omitted. This was done so following wide outrage over the illustrations depicted therein. The 2005 English language edition in color featured the new changes in the text and the scenes.

In this popular comic book too, the women are portrayed as sub-servient to the males. The women are almost minimised in the comic book. It is rather surprising to find that, in such a popular children's picture book, only one or two scenes are depicted hardly about the native women. The native woman is only portrayed as taking care of her husband. She is practically given no role to cater to. The language that she speaks is only a broken one. Tintin, the White hero, is seen coming to the rescue of one native Congolese man. The Comic Book projects Tintin as a wise arbiter of justice whose judgments are happily accepted by the natives for its fairness and wisdom. On another occasion, Tintin finds a native woman crying beside a sick native man lying on the mud house. The native woman tells him: "My Husband sick, mister... Boo hoo ! ... Him dying ! ...Bad juju come to live inside him...Boo hoo!"(Herge 28). Tintin then treats the native man with a dose of quinine, after which the man replies back that he no longer felt sick. In fact, he felt so much better that he went out hunting, while the native woman looked amazed at such a quick recovery. This incident highlights the ignorant and superstitious nature of the natives, for whom diseases were caused by evil spirits. At the same time it also marked elevation of Tintin in the eyes of the black woman to a godly status. The native woman praises Tintin in wonder, falling on her knees and exclaiming : "White man very great!...has good spirits...Him cure my husband!...White mister is big juju man!"(Herge 28).Snowy then exclaims in delight to Tintin that, "We're the tops, aren't we just?..." (Herge 28).

The women in *Tintin in the Congo* are also seen as having no opinion of their own, thus blindly following the dictates of the Congolese men. Everything that Tintin and Snowy achieve over the natives in the Congo, are rendered a symbolic status and fetishism, to be understood and interpreted by readers back in Europe in the right colonialist paradigm.

Finally, the last page illustration at the end of the book is the most significant of all. It shows the Congolese people talking about, praising, some even worshipping Tintin, bowing before the icons of the young reporter and his pet. A native woman is seen cautioning her son to be "good", otherwise he would never be able to be like the young reporter: "And if you not good, you never be like Tintin !"(Herge 62). The old men of the tribe of Congo, or the natives of Africa are seen discussing that they have never seen someone as the all-powerful young reporter, "Me never before see boula-matari, all-powerful, like Tintin !...."(Herge 62). While others growing such perceptions that all the white men in Europe resembled Tintin, "Them say, in Europe all young white men is like Tintin..."(Herge 69). Even the native dogs are seen as dreaming and talking of Snowy and praising him, "That Snowy...What a dog !" (Herge 62). The last page succeeds in idolizing Tintin and Snowy as the best of human kind.

For the natives in Congo, the young white reporter henceforth becomes an icon, a fetish to be worshipped. Thus, Tintin and his legacy continue to dominate the native psyche as a role model to be emulated, even in his absence. This is the ultimate achievement of Herge, on behalf of a colonizer. Even Tintin's dog Snowy is also seen to have an opinion about almost everything and portrayed as more sensible than the humans. But the native woman of Congo is only elated to see that a white man has cured her husband from illness. Therein lies the minimal role of a woman in a classic and a popular children's comic book.

Joanne Kathleen or J.K. Rowling's *Harry Potter* Series is very much popular with both children and adults alike. The books, indeed, were so much popular that these were said to be the primary reason for arousing children's interest into reading books again. Infact, these books remain popular to this very day. The *Harry Potter* Series contains a total of Seven books in the following order – *Harry Potter and the Philosopher's Stone* (1997), *Harry Potter and the Chamber of Secrets* (1998), *Harry Potter and the Prisoner of Azkaban* (1999), *Harry Potter and the Goblet of Fire* (2000), *Harry Potter and the Order of the Phoenix* (2003), *Harry Potter and the Half-Blood Prince* (2005)and *Harry Potter and the Deathly Hallows* (2007).

The popular fantasy book features Harry Potter, an orphan who is introduced to the readers in the very first of the Series, *Harry Potter and the Philosopher's Stone* (1997). Harry's parents were killed by the evil wizard, Lord Voldemort. Although Harry's parents, Lily and James Potter died in the attack, Harry miraculously survived. No one can escape Voldemort's attack and the Killing Curse – the "Avada Kedavra", but it was Harry who did so. And from that day onwards, Harry became famous as "The Boy Who Lived". But Voldemort's attack left the little child with a scar on his forehead similar to that of a lightning bolt. After the incident, Harry was left under the care of his uncle and aunt, Vernon Dursley and Petunia by the Hogwarts Headmaster, Albus Dumbledore. But his relatives were horrible and Harry had to live a miserable life there. The rest of the book deals with Harry's admission to Hogwarts School of Witchcraft and Wizardry, being friends with Ronald Weasley and Hermione

Granger, meeting Draco Malfoy, his enemy belonging from the pure-blood family and facing Lord Voldemort again. Although Hermione Granger is not a witch by birth, she remains the most intelligent irrespective of all. Even Bellatrix Lestrange, who is portrayed as a villain in the book, is seen as equally powerful in fighting back at her enemies.

The women are seen in some powerful roles all through the *Harry Potter* Series – unlike in any other fantasy novels. Rowling has portrayed a world where women are deemed to be equal with males. But Austin Cline in her essay, "Harry Potter and Women: Are Women Treated Equally in Harry Potter Stories?", raises some serious points in relation to the fantasy novel. According to Cline, "Many critics have alleged that J.K. Rowling has done the female readers of her Harry Potter Series of books a serious disservice by portraying a world where women are ostensibly equal (there are no formal rules that prohibit equality) but nevertheless remain in positions of inferiority. Men are in charge everywhere; women hold secondary positions at best. This supposedly sends the message that a social system which lacks forced inequality, but in which inequality is nevertheless pervasive, is normal and acceptable" (Cline Harry Potter).

On the other hand, Cline also cites about the positivity of women characters in the novel:

> Others, though, argue that female characters are very important in the Harry Potter books and, even if they aren't the primary characters, the books give no indication that women are inferior to men. Women are portrayed positively throughout the books and thereby provide positive role models to both male and female readers. Every fictional story has to have some primary and some secondary characters; the fact that the primary characters happen to be male while the secondary characters happen to be female is not necessarily sexist (Cline Harry Potter).

Also, the cultural and social necessity of children's literature books is significant so as to emphasize on gender sensitiveness. The books for children serve as a learning experience for children, particularly for children's books written for children and widely read by children. One example is Roald Dahl's *Matilda*. The book is about a female child who is a little. precocious girl with a passion for reading books. However, she is neglected by her parents who treat her in a bad manner. The female characters are underrepresented in major roles whereas the male characters are depicted in different ways and in different occupations. Also. different adjectives are used in a varied manner for the male and female characters. The book happens to be 'one of the widely acclaimed one which is why such representation lays a different impact on children.

Therefore, Children's Literature, inherently have huge imbalance in gender role stereotyping. Children's Literature, itself is a genre that has racism and sexism embedded in it. Most of the inherent meaning is subdued under the plot structure in Children's Literature. Although the role of women is constantly shifting towards a new horizon but the sad fact remains that still now nothing much has changed. Women are either not featured in primary roles or given importance with regard to their male counterparts. Children's Literature and its genres,

thereby, feature only women in a very passive and a timid role. As Brittany N. Maggiore states, "Passivity is the next most valued and honored attribute a woman can possess in a fairy tale. It is not the female who should save herself from harm or an undesirable situation; it is the male that must save her".

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Reflection of Culture and belief system of the Traditional Tripuri Society in Kokborok Folktales

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Abstract

Folklore existed within every community from times immemorial. It is as old as the human Society. Each Community has their respective folklores and folktales which is initially oral and passed down from generations to generations. Folktales are narrated by the members of that community and so it has an important historical significance in order to understand the social and cultural aspects of that particular society. Folktales serve as a mirror since it reflects the culture, social rules and belief system of the community. The Tripuri Community was no different in this respect and has huge collections of folktales, folk songs, riddles and proverbs which were passed down to the younger generations by the senior members of the society. The Tripuris belong to Tripura and their language is Kokborok. The Folktales narrate about the traditional medieval Tripuri Society but with time and due to their close existence with the Bengali Society, a cross-cultural influence of the Bengali culture is visible in the Tripuri culture and belief system. The paper attempts to find out the representation of the old traditional Tripuri culture and their belief system through the reading of selected myths, legends and folktales.

Key words: Folklore, Folktales, Tripuri Culture, migration, globalization

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Folklores are a collection of stories, riddles, myth, legends, proverbs and songs of an ethnic community. They mostly survived in the oral form and kept altering according to the changes in the society. The authors of the folktales are anonymous and not traceable and it is as old as human society. The Folklores generally serve the purpose of teaching values and cultures of the community to the younger generations. It contains the myth of creation, warnings for breaking taboos, festivals and the belief system of the particular community. A folktale which is a part of the Folk Literature is the most common form of narrating a story by an elderly of the Community to the younger ones. The tradition of narrating tales is still not ancient and it still continues in the present world. The children are taught morals and values of life through parables, fables and allegorical tales. Folktale also served the same purpose and the traditions, knowledge about the surrounding environment, morals, warnings and taboos are percolated to the next generation. The folktales of Tripura narrate about the culture, history, livelihood of the people of the region.

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The state of Tripura is located in the North-Eastern part of India. Tripura is the third smallest state of India consisting of 10491 sq km and shares half of its borders with Bangladesh and the rest with Assam and Mizoram. The population of Tripura mainly consists of Bengalis who are the majority and the rest belonging to different communities like the Tripuris, Bru, Halam, Jamatia, Chakma, Mog, Munda, Kuki, Garo, Darlong, Mizo etc. However, the demography of Tripura was not as we see it today. It has gone through a substantial change in the past due to many reasons. The partition of India and the religious riots of Bangladesh had a great impact on the demography. A huge number of Hindu Bengali families started settling in Tripura which brought a lot of cultural and social changes in the tribal culture of Tripura.

Kokborok is a language of the Bodo branch of the Tibeto Burman family and mainly spoken by the Debbarma, Jamatia, Koloi, Murasingh, Rupini, Reang, Noatia and Uchai etc. It is also used by the other indigenous communities of the state for communication purpose. Kokborok is also spoken by the Tripuris residing in Bangladesh. The total number of Kokborok speakers is approximately around nine lakhs.

The Kokborok speaking communities in the primordial times were Animists. They worshipped the spirits and the natural objects like Sun, Moon, Water etc. Like other tribal communities of North East India, the Borok people (Tripuris) were worshipers of nature, they have affinity with Animism. Animism believes that all-natural things like plants, animals, rocks etc. influences human activity. There is no difference in the existence of humans and animals, flora and fauna and other natural entities in Kokborok folktales. (Lalkulhpuia, 33).

Folktales are called *Kerang Kothoma* in Kokborok language wherein *Kerang* means a land tortoise and *Kothoma* means a tale despite the fact that land tortoise do not always feature in these tales and the nomenclature is unknown but it is in currency from the remotest past. (Murasingh, *Kokborok: Her People and Her Past* 283). The Kokborok Folktales are a rich granary of all sorts of tales where the life and culture of the Tripuri Community are reflected. It is a rich resource from where the primitive lives of the Tripuri Community can be traced. The Kokborok folktales mostly survived in the Oral form which is the case with most of the cultures around the globe. The written form is a very recent development. The daily lives and everyday issues can be observed through these tales. Folktales of Tripuris are full of variety and one can find themes of moral, social guidance and restrictions, ancient legends, fertility, taboos, creation and fate & destiny. Stories are in the form of beast-fable or of abstract character. Similar stories are also found among other tribes of Tripura. Some of the folktales of Tripuris have similarity with folktales of other countries too. (Murasing, *Tales and Tunes of Tripura Hills* x).

The folktales attempt to understand the natural phenomenon of the natural objects through the myths. It narrates about the origin of a place, the myths associated to trees, flowers, animals and other objects. The folktales narrate about the discovery of the deities and how the people came about to worship them. Over the period many different versions of the origin tales are seen in the Kokborok Folktales. Some attempts have been made by researchers and scholars

to compile the folktales into a book. One such book is edited and compiled by the famous poet of Tripura Shri Chandrakanta Murasingh, titled *"Tales and Tunes of the Tripura Hills"*. This book is a collection of myths, legends, songs, riddles, proverbs and folktales of Tripura. It is a translation of the Kokborok folktales into English language under the aegis of Sahitya Academy. To understand the culture and the belief system of the traditional Tripuri society few folktales are selected like *Golden Frog, the son of the moon, The Priest, Blood thirsty Gods, Khumpui,* and *Chethuwang.*

The Tripuri people have their own deities particular to the Tripuri Community. They worship *Mwtai Kotor* (Most powerful and supreme God), *Lampra, Twima* (the goddess of water), *Sangram, Mailuma and Khuluma* (two deities of Paddy and Cotton), *Noksu Mwtai* (Guardian deity of the household), *Thumnairok and Bonirok* (Deity of all disease and the messenger of death), *Burasa Mwtai* (deity connected with the evil), *Haichukma, Swkal mwtai, Ker* (deity who protects the village), *Goriya* (God of success) etc.

Origins of some deities are narrated in some of the Kokborok folktales like *Golden Frog, the Son of the Moon, The Priest* and *Blood Thirsty Gods*. We also see tales that talk about the origin of certain natural phenomenon and also moral teachings based on certain taboos as hold upon by the people. These are the tales and stories that are handed down from generation to generation. However, today, some expansions, additions and alterations have been made in these tales. (Murasingh, *Kokborok: Her People and Her Past* 283)

The tale of the *Golden Frog, the Son of the Moon* is a story about an orphan girl Kuphurti who was favoured and loved by the Moon God and miraculously conceived with the Moon God and delivered a Son in the form of a Golden Frog. The son was very unhappy with his frog skin and wanted to become a normal human but somehow, he was trapped in it. One day the son asked about his father and the mother narrated him the story of how he was born and that his father was the Moon God and so he was named as Chandra Kumar. The mother was very protective of her son and did not allow him to go to the market as someone might trample over him. But one day the Frog son requested his mother to let him see the world and with a lot of reluctance the mother agreed. A little distance after hopping he hides in a bush and calls on to his father and the Moon God appears and the son requests him to build them a good *gayring* (small bamboo hut on the stilts) and on other days he asked for some money. One day he requested his father to turn him into a human permanently to which the Moon God replied "Don't be unhappy my child. You will have to be a frog for some more time. And then the time will come when the frog's skin from your body will come off. But from now on, you can shed the frog's skin from your body whenever you like and can move about as a man. And then you must wear the skin again when you have finished doing what you wanted to do as a man. And then mind you, you should never do that act of shedding and wearing the skin when the people are around". He moved about in the form of man and meets a princess and she falls in love with him at first sight and they continue to meet everyday either in the palace or the gardens. On one such days the Princess became curious to know about his family and he narrates the sad plight of his mother how she had to leave her village because she conceived him without a husband and that his father was the Moon God and he

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was born as a Golden frog. The Princess was amazed to hear the story and found it unbelievable and he tells her that he shall appear as a frog the next day but will she accept him or hate him? To which she replies that man or beast she has accepted him as her soul mate so it wouldn't matter if he appears before her as a Frog. Next day he comes in the form of the frog and the feelings of the princess did not change and they ultimately get married much against the wishes of the King and the queen. Life continued and Chandra Kumar lived both in a human form and that of a frog. One fine day the princess decides to burn his frog skin while he was asleep "but as soon as she was about to touch the coat, someone in man's voice said from inside it, O princess, I am Nokshu mwtai (household deity). I kept myself wrapped upon the body of Chandra Kumar so that my worship among the people spread far and wide. It will be beneficial to you.

The princess said, "What will be the benefits of worshipping you? Where do you reside?"

The god said, "I'll live is a corner of the house. If you worship me I'll protect you and your house from the evil gods."

The princess agreed to make arrangements for the worship of the God.

The princess had loosened her grip on the skin coat a little. At once Nokshu mwtai vanished in the thin air. The princess threw the skin into fire."

Chandra Kumar turns into human forever and the king and queen reconciles back with them after the villagers were full of praise for the couple. One day the king decides to hand over his kingdom and subjects to Chandra since he' did not have a son and Chandra kumar ascended the throne with great pomp. "The occasion brought his mother and all his neighbours to the palace. The moon god came down to bless him saying, "from today onwards you will be known as the king of the lunar dynasty. Your descendents will rule this state for ages to come with great fame." Before departing the moon god gave him an arrow with a half-moon shaped tip.......his subjects thus called him 'Fa', the father." (Murasingh, 2020: 43-51).

The story seems to be a distorted version of the lineage of the kings of Tripura. This tale corresponds with the myth of origin of the kings from the Lunar dynasty and previously the kings were given titles as 'Fa' which is mentioned in the *Rajmala*. Interestingly it also brings to the mind the fairy tale of the Frog prince from the collection of written fairy tales by the Grimms Brothers which is quite surprising. Through this tale we get an account of the Nokshu mwtai the household deity worshipped by the Tripuri society for protecting the house from evil gods. It is important to note here that the tale serves as a teaching on the Nokshu mwtai, where he resides and how he started to be worshipped by the Tripuri people. It is believed in villages that the Nokshu mwtai protects the house that worships it and so it is feared by all the Community and the elders warn the children not to go to the corners of the house lest because it might anger the God and he/she might fall sick.

In the next tale of *The Priest* we see the story of a widow and her lazy son who was not willing to work. She was growing old day by day but the boy was too lazy to work. One day the mother said to her son "All the people of the village are now going to the jum to set fire to their plots...... She said, 'My son, before you start the fire offer prayers to the gods and goddesses. And be careful. The fire may kill the children of the animals who live in that jungle. Ask their forgiveness, say, 'Don't curse me if your children get into the fire. I am only doing what my forefathers did before me. I am setting the fire to this jungle because I have to.'

He sets the fire to the forest but due to his laziness, he forgets to offer his prayers and burns the children of the king of the serpents which have vowed revenge on him and coiled itself seven times and kept hissing aloud. His mother was trapped inside the house and he did not know how to save her. The mother knew what her son has done but now it could not be undone so she instructs the son "Take a black cock, some parched rice, a bottle of liquor, some bamboo pieces, a banana leaf, a little turmeric and go to the forest. And there call out, 'Uncle, uncle'. The uncle will come to you. He will tell you what to do. The boy went to the forest and began to shout, 'uncle, uncle'. Nobody answered. Then he went on shouting all day roaming in the jungle till at last someone from a narrow valley below answered- 'ui-i-i-i'. Following that sound the boy came upon a big, tall dark old man."

He narrates the incident to the old man and after listening to the boy the old man instructs him to act as the Ochai (priest who performs rituals in Kokborok Society) but the boy says he don't know how to act as one. The old man chanted an incantation which the boy repeated and cuts of the banana leaf into seven times and as he went on uttering, the coil of the serpent loosen its grip over his house and finally fell on the ground, its body cut into seven pieces........The old man was actually Burasa, the God of woods. So, it started to be believed that if Burasa is appeased he helps them get over their troubles". (Murasingh , 2020: 117-120).

The above tale provides information on how to conduct the ceremony and that in the Tripuri society; it is an Ochai (priest), who officiates the religious rituals. The Tripuris offered prayers to the Burasa mwtai when they were inflicted with some diseases and it is believed that he will remove the sickness and troubles from the family. It also serves as a moral lesson for being lazy and disobedient. At the same time, it reflects the primitive lives of the Tripuris and their means of livelihood. They were nomadic tribes and their main occupation was shifting or jhum cultivation. They lived a very simple life and depended highly on the produce of their jhum fields. Being animists, they worshipped the natural objects and maintained peace and harmony with the environment. The son was asked by the mother to offer prayers before doing his work which shows their devotion to their deities. The consciousness for protecting the environment is visible in the society from long time which was mainly due to their belief that God existed in all objects of nature.

The next tale Blood thirsty Gods is about the 14 Gods of Tripura. Animal sacrifice to appease the gods has been practiced from a very long time is also visible in the history of Tripura and in the Rajmala which continues to exists till today on important festivals like Kharchi

(festival of the 14 Gods). Though in the Rajmala, the worship of the 14 gods began due to the instruction of Lord Siva but this folktale narrate another version about how Queen Heeraboti, the mother of Trilochan rescued the gods from a buffalo who were stuck on a tree for seven days because the creature won't go away. The Queen with the help of her *Risa* (a cloth worn on the chest by Tripuri Women) pacifies the buffalo and rescues the gods and brings them home with her. Queen Heeraboti takes proper care of the gods by offering them good foods to eat and also lets the young Trilochan play with them. One day she was bothered with the health of her son since he was turning very weak and thin and to her amazement, she discovers that the gods have been turning him into a goat and drank his blood and turned him back to human. After the discovery the gods were very ashamed about their actions and asks forgiveness but Queen Heeraboti thought that she had committed a great mistake in not enquiring about the taste and preference of the gods right at the beginning. She further assures them that "from today onwards you will be provided with an offering of blood from the sacrifice of a goat regularly." (Murasingh, 129-133). The tales have the traditions of the Tripuri society and this tale has more significance with the royal family since the ceremony or puja in earlier times was only celebrated by the royal family but now the festival is open for all to celebrate. Kharchi Puja is one of the most important festivals in Tripura and celebrated in the manner as it is mentioned in the tales with sacrificing of the goats. The above three tales could be the account of some of the rituals, festivals and the belief system of the early Tripuri society which still exist but in more sort of a deformed manner. The idols of the 14 gods are placed in the Chaturdasa Devta Mandir in Tripura and the worshipping of an image or an idol is visible amongst the Tripuri Society in the present days which probably is the influence of the Hindu tradition since the other gods and goddesses do not have any image form and shape earlier. Inter cultural influence is most visible in the form of worship since along with animism the worship of images and shapes are also practiced in the contemporary times. The above tales could well serve as the mythological tales of the origin of the gods and their manners. The gods are human like and they have emotions like humans. Every story has an intended or unintended moral teaching about the rewards of patience, hard work and sincerity and warns against deceit and disobedience.

Besides this, the Tripuris also highly believed in spirits and were worshippers of nature since they lived in close proximity to nature. One other reason could also be that since they were mainly jhumias they were highly dependent on nature for their survival. Some tales also explain the natural phenomenon of places and its history. One such tale is of Khumpui where the two sisters Raima and Saima who had to work in the jhum because their father was an Ochai and their mother was dead. Everyone had *gayring* in their Jhum field except the sisters and they had nowhere to rest on days when the sun was scorching hot and on stormy days. On one such day the devastated elder sister says that I shall marry any man or beast who will build us a gayring. Strangely enough they find a new *gayring* on their Jhum field the next day and Raima requests her sister to call her *kumui* (brother-in-law) for lunch and much to their surprise a python comes shushing through the jungle but Raima saw him as a handsome prince. Days went by and one day the father discovers the story from the younger sister Saima and with her help kills the python. Raima who was working in someone else's jhum field felt strange as her bangles and earrings fall off. She rushes back home and immediately

confronts her sister Saima and learns about what has happened to her python husband. She sets forth to find the slayed head of her husband and they reach a place where the beautiful Khumpui is blooming and both sisters pluck a flower each and puts them on their locks. The younger sister Saima felt strange to see that her flowered withered the moment she puts it on whereas the same withered flower bloomed fresh once the elder sister Raima puts it on her locks. This phenomenon gives the clue to Raima that her python husband's head must be somewhere nearby and he says to her sister if our tales is to be narrated and remembered then as I call your kumui the dongor (a stream) shall cover me entirely and take me away. As she sings

"Dongoiyoi dongoi dongoiyoi

Nasingradi dongoi (Dongoi wait for me)

Twima Torwrwk (the water body is rising)

Khumpui barwrwk (Khumpui's are blooming)

Naisinggradi dongoi (oh Dongoi wait for me)"

The water kept rising and ultimately takes the longing wife to her husband and the Dongor is said to be the present Dumboor in Tripura which is a confluence of these two rivers Raima and Saima. This place is considered holy by the people of Tripura. The story of Raima and her husband is further mentioned to be the story of Shiv and Parbati of the Hindu religion which shows the admixture in the philosophy of two religions. In 'the folk tale it is very evident that the people lived in close proximity with nature and they worshipped nature and they believed it was a living being. This tale also confirms the occupation of the Tripuris and the background is also set in a jhum field. It also shows the devotion of the wife for her husband. The waters were considered very important in the Tripuri Society and the rivers were worshipped and each had names and people feared to pollute the waters which might anger the goddess of water. Since, they were animists and believed that all things in nature were living, so there was a respect and fear for all the natural objects and a peaceful relationship between man and environment was evident.

The folk tales sometimes also serve as a social warning as in the tale Chethuwang a brother desires to marry his younger sister which is not accepted in the Tripuri Society. Incest is looked upon with grave seriousness and the society does not allow it. The sister was very devastated with the decisions of her family and she starts worshipping the Chethuwang tree to rescue her from this sinful world. The tree started growing taller and stronger as she sings a song to it and ultimately, she climbs the tree and reaches the sky and kicks off the top branch of the Chethuwang tree as she ascends to heaven and her brother dies as the branch fell on him. It is believed that the Chethuwang tree does not have a top from that day onwards. It warns the society against such sinful acts.

The folktale of Tripura thus gives a reflection of the traditional Tripuri Society and their means of livelihood. Some of their folktales also hint about the influence of Hinduism in the

belief system of Tripura. But, if most of the folktales are studied it can be confirmed that they followed animism and in tribal societies no particular temple existed for the deities like the Hindu society. But the influence of Hindu society under the patronage of Tripura Kings was so influential that these traditional beliefs of tribal societies are modified. The mixture of Hindu religion and traditional tribal religion was strengthened more with the narratives of *Rajmala*. And these narratives were influential to make Hindu culture dominant over the culture of Borok people for a long time. (Lalkulhpuia, 34)

Since the *Rajmala* gives a very sanskritised account of the Kings of Tripura and it does not account or narrate anything about the subjects of Tripura, Kokborok which is the language of the Borok community did not find any representation in the *Rajmala*. The original language of the kings of Tripura was Kokborok, but they choosed the Bengali Language as the language of the Court. Kokborok language was the language of the common man and the language of the Court was Bengali which ultimately influenced the majority. Chandrakanta Murasingh, a Poet opined that during princely rule the language Kokborok was neglected and due status was not given. (Murasingh, *The World of Folk Literature: Kokborok* 6). The change happened gradually and due to the two communities living side by side, there is multiculturalism in every aspect of social, cultural and the belief system of the Tripuris. The changes altered a lot of primitive religions, social and cultural aspects of the Tripuris.The demography, language, culture, social and the belief system of Tripura has undergone a lot of transformation. The Tribal people of Tripura constituted majority of the population during pre-independence period. Tripuris had their own tribal religion, but it was modified with Hinduism under the rule of the Tripura Kings (Wahal 88). The changes could be mostly reflected in the belief system of Tripura and this ultimately brought a change in the social and cultural lives of the Tripuri Community.

Thus, we see that the Tripuris' struggle from identity crisis when it comes to their social, cultural and belief system due to the influence of Hinduism from a very long time. At the same time the people are slowly moving away from their old ways of life due to the modern life style and the stories which existed mostly in the oral form is getting forgotten and laid back.Kokborok Folktales remained mostly oral and it is only recently that some works are translated in written format. It can also be observed that due to modernism and globalization, the young generation hardly knows or cares about any of these folktales and the cultures are therefore more alienated to the new generation. Reviving the interest in the past and its culture is only possible if we could somehow generate the interests among the young minds once again to go back to these rich filled folklores and folktales to dig out the history and roots of the glorious past of the Tripuri Community. But since the education system focuses mainly on the 'reading and writing', the oral tradition is being neglected which poses a problem for folktales since it was created to be narrated and this skill is not practiced and encouraged in the modern education system. The main hindrance to this is as Alan Dundes points out that the folk is considered to be primitive and has a paradoxical situation where the folktales and folklores are considered a national treasure but it is associated with the illiterate and uneducated (Dundes 56). But Folktales are not of the past, they are evolving along with the human society and they serve as the first resource for introspection in the past when the

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written documents did not exist. The lives of the common people in Tripura did not have a written record of their past culture and belief system but the folktales handed over from person to person survived among the people giving them enough knowledge about their ancestors and rich heritage.

Folktales are stories that are placed in a timeless setting and which evolved from the everyday lives of the common people. It was a source of knowledge about the daily lives and struggles of the common folk. They used the medium of story telling to express their desires, creative thinking and artistic skills. The emphasis is laid more on the written documents but the oral tradition of the ethnic Communities could serve as a social history and provide information about their culture, taboos, legends and belief system. Therefore these folktales act as a guide to the remote unknown past of the Kokborok speaking people and also serve as important collections of the brilliant minds of the ancient people who were so artistic and creative.

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Autonomy Movement in Northeast India: Understanding from Gandhian Idea of Self-Rule

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Abstract

The Northeast India has been experiencingautonomy movement since the time of the British colonial period. However, the intensity of the movement increased in the post indepndence period. The government of India adopted many legal and constitutional measures to address the issue by giving autonomy under the Sixth Schedule of the Indian Constitution and Bengal Eastern Frontier Regulation, 1873, commonly known as Inner Line Regulation. But the existing political scenario in Northeast India indicates that autonomy movement has not been contained. Rather, it is likely to gain new momentum in the coming days.

The paper, therefore, tries to analyse the issue of autonomy movement in Northeast India from the perspective of Gandhian Idea of Self-Rule. An attempt is made to examine on how the question of autonomy can be addressed by Gandhian perspective of 'self rule'.

Keywords: Self-Rule, Autonomy, Movement, Northeast.

Introduction:

The concept of autonomy had initially come into focus in ancient Greece and was derived from the Greek words – *auto-nomos* which characterised a city state that was self-governing (https://iep.utm.edu/autonomy/). At latter stage, during the European Enlightenment in the 17th and 8th Century, autonomy come to be widely understood as a property of persons – the property of having one's decisions respected and honored within a political setting. At present, the concept of autonomy is used in both senses, although most contemporary philosophers deal with autonomy primarily as a property of persons.

In short, autonomy is nothing but one's own faculty for self-determination and self-governance. Otherwise, it is a much contradictory issue that comes up in a number of different arenas. Most of the philosophers basically categorised autonomy from personal, moral and political autonomy perspective. Moral autonomy, which is usually traced back to Immanuel Kant, is defined as the capacity to deliberate and to give oneself the moral law rather than merely giving attention to the dictates of others. By personal autonomy, it is the capability to make a choice for oneself and accordingly follow a course of activities in a personal life in spite of any certain moral content. Political autonomy on the other hand may be explained as the possessions of having one's choices respected within a political realm (https://iep.utm.edu/autonomy/).

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The autonomy movement in the Northeast India mostly took the forms of insurgency among various ethnic groups. For instance, National Democratic Front of Bodoland (NDFB) [i] in Assam, and United Kuki Liberation Front (UKLF) [ii] in Manipur are the existing insurgent groups in the region fighting for autonomy. The autonomy movement in the Northeast India can be broadly categorised into three groups/categories. One group of them demands political autonomy within the existing federal setting of India-example is the Hmar People's Convention – Democracy (HPCD) which demands an autonomous district council in the state of Mizoram. Secondly, the other group demands a separate statehood within the existing constitutional framework of India-example may be given of the Bodo movement in the state of Assam. The third group demands a complete independence and secession from the India Union – like the Naga movement in the state of Nagaland under the banner of National Socialist Council of Nagaland (NSCN). In general, in most cases, the movement evolved to represent the grievances of the people such as poor governance, land alienation, lack of development, an apathetic attitude of the central government and even because of inter-ethnic conflict. At present, the general trend of autonomy movement in the Northeast India indicates more inclination on the first two categories.

Gandhi's Concept of Self-Rule:

The concept of self-rule/*swaraj* had developed during the Indian freedom movement. Gandhi in his book *Hind Swaraj* (1909) had sought to explain that the meaning of self-rule was much more than merely wanting the system of the rule of English without the Englishman, that is, a kind of the tiger's nature but not the tiger. Gandhi's basic argument centered on the belief that the socio-spiritual foundations of the British political, economic, bureaucratic, legal, military and educational institutions were intrinsically unjust, exploitative and much alienating. Through *Hind Swaraj*, Gandhi tried to identify the moral shortfall of western civilization, especially industrialisation as the model for free India.

From another perspective of Gandhi's idea of self-rule, it represents a genuine attempt to regain control of the 'self' including self-respect, self-responsibility and capacities for self-realisation from the institution of dehumanisation, which is the denial of full humanness in others. The real objective of the freedom movement was not only to secure political independence from the British but also to gain true *swaraj*, that is, liberation and self-rule. His idea of *Swaraj* was based his concept of decentralization of economic and political power. He developed the concept of decentralization of power and took it to the local and village level and introduced the concept of *Gram swaraj*.

Gandhi liked to reject and uproot the British rule from within themselves and the communities. He also wished to restore new reference points, systems and structures that would enable individuals for collective self-development. This restoration had to grow from the strengths, wisdom, knowledge and experiences of people living in village India, rather than from cities in Britain, America and for that matter even in India. The understanding of the real 'Self' and its correlation with the communities and society is significant to the mission of attaining *Swaraj*.

Studies on Autonomy Movement:

There are numbers of literatures on the study of autonomy movement in the Northeast India. In the political arena, there are certain discourses among various stakeholders on autonomy movement and how to reach to a point and strike a balance among various ethnic groups. In fact, autonomy has become an instrument for negotiating competing claims in multi-ethnic and multi-religious state. It has been seen as a panacea for solving ethnic conflicts in different parts of the world (Ghai, 2000, p. 1).

The need of autonomy is felt at a particular stage of internal development of a community. It can never be an independent demand. It occurs when large number of people or otherwise an identifiable segment of the population deliberatelygrouped together for collective actions in order to change, reconstitute, reinterpret, restore, protect,supplant or create some portions of their culture or social order or better life changes by redistributing the power or control in a society (Tuolor, 2013, pp. 2249-7382).

Another point of debates relating to the autonomy movement is because of the neglect of indigenous languages, and culture. This provides the impetus for identity formation. The issue of non-development and developmental devastation was subsequently linked to this process. In this connection, A.L. Raj pointed out that, 'from being a struggle of tribal masses to preserve, strengthen and assert their distinct ethnic culture, identity, values, history and independence, the Jharkand movement in the course of its long existence has slowly and steadily been transformed into a movement for the development of the tribals much along the same path as that of their non tribal neighbours' (A.L Raj, 1992, p.200-203).

So, the autonomy movement is the expression of the inner tension and turmoil within the society not only at socio economic and political levels but also at the level of religious beliefs and to revitalize indigenous belief systems. The origin of autonomy movement in the Northeast India, by several ethnic groups, right from the colonial era is also by and large linked to the feeling of threat to their language, culture and religious traditions (N.K Das, 2011, pp. 37-61). Upliftment of the identity and its preservation may be the focal point of autonomy movement. According to A.P.K Singh, several ethnic groups in Northeast India generally resorted to the politics of autonomy movement while trying to preserve their ethnic identity. However, as time went on, the movement and demand for autonomy by several ethnic groups has been escalating in the region. Some of the movements are democratic while others are armed movement (A.P.K Singh, 2016, p. 2321-8819).

Objective of the Study:

In fact, Northeast India has been experiencing series of autonomy movement across the region from different ethnic groups since India's Independence. The region, especially the hilly areas, is predominantly inhabited by the indigenous tribes having their respective distinct cultures and traditions. History depicts that most of the ethnic communities have been

living for decades without the interference of outside administrative mechanism. Hence, their relationship and interface with outside population was very minimal. But their interaction with the outside environment after India's independence, coupled with population influx from outside the region put them into a situation where they had to struggle for the preservation of their identity through certain degree of political autonomy.

The Government of India has adopted and enacted numbers of legal and constitutional measures to address the issue of autonomy movement in the Northeast India. For instance, Sixth Schedule of the Indian Constitution and the adoption of Bengal Eastern Frontier Regulation, 1873 (commonly known as Inner Line Regulation) are legal and constitutional measures that facilitated the Northeast Indian communities to administer according to their own intellect.

But over the years it has been experienced that autonomy movement in northeast India is gaining a new momentum. Despite the legal and constitutional measures meant for ensuring autonomy to the Northeast communities, the existing sociopolitical scenario indicates that autonomy movement is likely to recuperate in the coming days.

Hence, the paper makes an attempt to analyse and understand the concept of autonomy from the Gandhian perspective of self-rule, and relates to the autonomy movement in the Northeast India. Gandhi stated that, it is *swaraj* when we learn to rule ourselves (Hind Swaraj 1909). The question, therefore, arises whether the communities in the Northeast have the real awareness and understanding to administer and govern themselves with the political autonomy as laid down in the Indian constitution.

Autonomy movement in the Northeast India and Gandhian Self-Rule:

Autonomy movement in the Northeast India is basically a movement for political autonomy. As stated earlier, indigenous tribes in this region have their own distinct culture and traditions. But excessive interference of outside cultures which appeared to them as alien to them has created frustration among them. This has resulted in the emergence of autonomy movement among various groups. The government of India has given certain provisions for the autonomy of the indigenous tribes within the existing legal and constitutional framework since India's independence. For instance, the Sixth Schedule of the Indian constitution is a legal framework that provides autonomous status to different scheduled tribes (STs) inhabited areas in the Northeast India. Through this provision, the STs have been given the power and responsibility to administer themselves according to their cultures and tradition. In other words, they were given the status of self-rule and self-government through constitutional and legal measures. The Bengal Eastern Frontier Regulation, 1873 commonly known as Inner Line Regulation is another mechanism that ensures the protection of the cultures, tradition, including land alienation problems of indigenous tribes.

But whether the extent of autonomy enjoyed by them helps to reduce their socio-economic and political problems is a pertinent question. An analysis of the functioning of autonomous

district council under the Sixth Schedule of the Indian constitution shows contrasting evidence with Gandhian idea of self-rule. The focal point of autonomy movement by various indigenous groups confines to only politics of identity. Gandhi said that real *swaraj* is experienced when we learn to rule within ourselves. The actual purpose of the freedom struggle was not only to achieve political independence from the British but rather to gain true *swaraj*, which is liberation and self-rule (Hind Swaraj 1909). The extent of the nature and characteristic of dependency relating to economic and socio-cultural aspect among the indigenous tribes is very high. They failed to realise that self-rule is not mere political autonomy.

In addition, most of the district councils under the Sixth Schedule have a record of rampant corruption. They are also unable to utilise the resources they have at their disposal. They have been totally dependent on outside sources for food and other basic necessities in life. Business sector within the district council is mainly controlled by outsiders. Gandhi again said that the real meaning of *Poorna Swaraj* (full independence) and what is expected from *Poorna Swaraj* is an awakening among the masses, that is, a knowledge among them of their true interest and ability to serve that interest against the whole world with peace and harmony, freedom from outside aggression and also from within and a continuous development in the economic condition of the common masses (Young India 1931: 147). Many indigenous tribes have been losing their cultures and traditions and have more inclination to outside practices. They have been influenced by the outsiders to the extent that they are unable to speak even their mother tongue.

Considering all these aspects, the indigenous tribes in the Northeast India who are demanding autonomy one after another have not experienced the Gandhian idea of self-rule. It is imperative that the indigenous tribes need to understand the implications of self-rule. Gandhi clearly stated that self-rule represents an attempt to regain control of the 'self' including self-respect, self-responsibility and capacities for self-realisation from the institutions of dehumanisation. But the indigenous tribes basically failed to retain the core characteristic of 'self-rule' that is, self-respect, self-responsibility and self-realisation.

It is also equally important for the indigenous tribes to understand by the indigenous tribes that political autonomy is not only the attributes to preserve their culture and traditions. Had it been so, the government has given several constitutional provisions to the Northeast indigenous tribes, and this would have acted as a strong mechanism to retain their distinctiveness. But experience shows that autonomy movement has been mushrooming and is likely to get momentum in the coming days. This merely indicates the urge of the indigenous tribes for further autonomy. Here lies the significance of the understanding of Gandhian idea of self-rule, where Gandhi gives equal importance to social, economic, cultural and moral independence alongside political independence.

Conclusion:

Considering the legal and constitutional measures undertaken by the government of India in extending autonomy to the indigenous tribes in the Northeast India, it can be argued that priority is given only to political autonomy. The government could equally consider the social, economic and cultural aspectsw of the tribes so as to make them more aware. Employment generation scheme at village level have to be implemented in a rigorous manner so as to make them self-reliance and self-supporting. Gandhi rightly again said that the journey to *Swaraj* is a painful and challenging scale and it requires full attention and full commitment. It indicates a vast organizing ability, penetrating deep into the villages with the objective for the service of the villagers. In other words, it means national education of the masses across societies irrespective of caste and creed. It also signifies an awakening of national consciousness and awareness among the masses (Young India 1925: 178). Similarly, codification of customary laws of the indigenous tribes has to be initiated by the government. Under the present setting, most of the customary laws being practiced are uncodified and undocumented. Hence, in many cases there is often contradiction with the municipal laws of the judiciary.

Notes

[1]
For further information on the demand of National Democratic Front of Bodoland (NDFB) please see https://indianexpress.com/article/explained/explained-what-is-the-bodoland-dispute-and-who-are-the-ndfb-6136083/

[2]
For further information on the demand of United Kuki Liberation Front (UKLF) please see
https://www.satp.org/satporgtp/countries/india/states/manipur/terrorist_outfits/UKLF.htm

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Women and COVID-19: An Analysis in Indian Situation

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Abstract

'COVID-19' has left no areas of discussion untouched in contemporary time and society. Itsvirulent nature has affected each and every natural creature on earth and thedifferent areas around them. In case of humans it is the socio-economic, political, environmental, cultural and many other areas which have been affected with the extremity of harmfulness. It has made the 'women's alreadyagonized world' abaleful one. Inthis paper we shall try to discuss how women in India have been facing different kinds of violence just because of the existing pandemic situation. Evidence used to support arguments have beencollected from secondary sources. The paper will try to reveal the actual happenings with many women of our society and thereby, will help reach the women's voice to the concerned bodies.

Key words: Women, Violence, COVID-19.

Introduction

It is needless to say that the contemporary academic, socio-economic, political and all otherarena is actively concerned with the issue of COVID-19, an infectious disease caused by a virus namely SARS CoV-2. It is a novel virus of the Corona Virus family, transmitted through contacts and droplets mostly, which affects humans and animals as well. Most common symptoms of corona virus disease include fever, tiredness and dry cough among humans. Sometimes people affected with this virus recover without any special treatment; however, people with co-morbidity are more vulnerable to the disease and death is often the consequence in such cases.

The first positive case of corona virus infection was reported in Wuhan, China on12th December, 2019 and on 31 December, 2019 the Chinese authorities alerted World Health Organisation (WHO) about cases of pneumonia of an unknown etiology. The China identified the new virus as nCov-19 on January 7, 2020. On January 13, 2020 the Ministry of Public Health, Thailand confirmed the first case of COVID-19 outside China. In January Japan and Korea also confirmed cases of COVID 19.On January 20, 2020, a total number of 282 confirmed cases of corona virus infections came up from different countries like China (278 cases), Thailand (2 cases), Japan (1 case) and the Republic of Korea (1 case) (WHO, Situation Report-1, 2020).But on March 11, 2020 the disease rapidly covered upmore than 100 countries of the worldas is evident from the Corona virus Disease 2019 Situation Report-51 published by World Health Organization(WHO) which shows that there had been a number of 118, 319 positive cases of infections from all over world. (WHO, Situation Report-51, 2020).

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Looking into the serious consequences, leading to higher rates of mortality, of the problem, the WHO on March 11, 2020 declared this life threatening disease as pandemic one by naming it as COVID-19. It is very much unfortunate that India also could not keep herself free from the perils of this death-dealing virus and the first positive case of COVID-19 was identified on January 30, 2020. Since then the number has been on rise and the Report of Ministry of Health and Family Welfare, Government of India shows the current number of positive cases in the country as 30,44,940 on August 23, 2020.(my GOV, COVID-19 Dashboard, August 23, 2020).

From the above data, one can easily understand the acuteness of the problem arising out due to the rapid rate of spread of the disease and the worst part is that no medicine or vaccines could be invented yet to give a fight back to this deadly virus; Only Russia launched its vaccine though very recently but it is still unknown that if this would really work out effectively. India is yet to achieve success in this matter. However, the mortality rate in India, hence, is also alarming; till July 26, 2020 there have been 32063 cases of deaths only in India due to COVID-19. (MoHFW, Covid-19 Statewise Status, July 26, 2020).Statistics presented in this paper are of initial periods of the spread of virusonly in the county which again compels us to think about the extremity of the issue. There remained no alternative left to the Government other than to introduce lockdown in the country seeing this statistics. Lockdown was considered as the only possible means to check the human gatherings in roads, shops, offices, institutes and other places as well. Direct and close physical contacts have also been suggested to avoid; different other means have also been developed later on and with time though. Finally, to break the chain of imminent spreading of COVID 19, the Government of India declared 21 Days of total lockdown throughout the country on March 24, 2020. However, it was extended till May 31, 2020 later on. Though presently we are in the unlock phases but there are several sectors including education and like this which are still under lockdown. Lockdown on the one hand was an imperative to reduce the spread of virus among human beings but it has several negative effects as well on the day-to-day life of people on the other. Lockdown in India has been one of the world's largest lockdown which means closed down of all factories, markets, shops, places of worship, suspension of public/private transport and halt of construction and developmental works also. According to a report of the Hindu, over 12.2 crore people lost their employment in the month of April, 2020 and ¾ of them were small traders and wage-laborer (The Hindu Data Team, Job loss mounts, May 7, 2020). In such situations many jobless persons stayed at home and even many people with a cut of specific percentage in their salaries and others from different fields have been working from home. There has been hardly any improvement in this scenario till date. All these situations have a distinct psychological impact on people. People have often been facing mental stress which has been manifested in different ways in their families. In most cases, depression or any kind of mental stress among people is often expressed in the form of anger or any violent acts. It would be a redundant utterance now if I describe here the condition of women in an patriarchal Indian social set up; so, it can be envisaged easily that how women staying at home and working outside as well during the lockdown period would have to face different kinds of violence at the hands of people in general.Women have been even facing various types of violence in their regular duties in post-lockdown period also. The paper will

try to focus on different kinds of violence that women in our country had to face both in and outside family during the periods of lockdown and till now. Emphasis shall be given on psychological issues related to women; violence against them at domestic level and the types of problems faced by women frontline workers. Therefore, it will try to come up with some possible measures to reduce the extent of violence against women and upholding their human rights.

Methodology:

The paper is prepared on the basis of secondary data available on the internet. Discussions have been based primarily on different news paper reports published on issues related to women.

Discussions:

As we know it, women in any situation are the primary victims of any kind of violence; a number of protective measures have been already in place though at national and international levels including Convention on the Elimination of All Forms of Discrimination against Women and many others. Apart from it, the Indian Constitution and legal mechanisms of the country have also been there giving women protection from different unpleasant situations and violence. But it is really miserable and painful that there is hardly any improvement in the situation. The context we are focusing on here is the psychological one which women have been passing through in our country because of the ongoing pandemic situation.

It is an undeniable fact that across the globe, women earn less and they are engaged mostly in 'unproductive' domestic activity in terms of economic contributions and the majority of them engaged in different sectors, are mainly an unsecured one where anyone can be laid off any time and with minimal unequal wages as well, if employed. Indian women are not an exception. The ongoing lockdown due to the present pandemic situation contributes more to this situation. Azim Premji University has conducted a survey in 12 states of India, and the report shows that the condition of female workers is worse than that of male workers. In the rural areas 71% of casual workers lost their employment during this lockdown (Swaminathan, 2020). Women working in agricultural sectors, textiles factories also lose their employment because of this lockdown. Loss of earnings place women in a state of economic dependence on their family members which in turn become a cause of both psychological and hence, physical unwellness among them.Thus losing a job has an adverse affect in long run by not allowing women to be economically independent even when many of them are willing to be.

In such situation, when the jobless women and men too in many cases have been living together under the same roof it is mostly women who have to perform all domestic chores and take care of kids as well. Looking after the needs of each and every family members directly or indirectly also become the duty of the women in the family. Thus the traditional stereotype gender role gets primacy again in the family system and it worsens the situation of

women more. One incident can be cited here that shows a woman known as Geeta was being beaten up inhumanly, even in front of her children, by her drunk husband, a rickshaw puller due to the drop down in his income from 1500 to 700 during lockdown (Mohan, 2020). Marianne Hester, a Bristol University sociologist believes that domestic violence goes up whenever families spend more time together (The New York Times, A New Covid-19 Crisis: Domestic Abuse Rises Worldwide, 2020).

According to a report published in The Hindu (Date June 22, 2020 Page 7) during lockdown period i.e. from March 25 till the end of May 2020 the number of cases registered for domestic violence in India is more if it is compared with the similar period of last ten years. And these record is only for the registered cases, 86% women who are the sufferers of violence do not seek any help in India (The Hindu Data Team, Silent Victims of Violence, June 22, 2020).According to the report by published by National Commission for Women, the Complaints and Investigation Cell of National Commission for Women, India, in between March to May 2020, has received a number of 4374 complaints which is more higher than the complaints it received for the similar period in the year 2019 i.e., 3867 [NCW, Rashtra Mahila, 1 (232, 233, 243, 244, 245), 2019, 2020]. Not only these, there is every possibilities of sexual exploitation of women by men during their long periods of living together. All these place women in a state of depression and other psychological issues too. Looking into the grave consequences of the problem NCW has conveyed a meeting on May 29, 2020 through video conference with all DGPs or their representatives regarding the steps to be taken to reduce domestic violence and cyber crimes against women [NCW, Rashtra Mahila, 1 (245), 2020].

Another important area to be focused on here is the day-to-day problems faced by many women warrior of covid-19 who have been working in an extremely life-threatening environment since last few months. Frontline Covid-warriors include doctors, nurses, ANM, Accredited Social Health Activist (ASHA), workers of Anganwadi, police personnel and like this who have been trying hard 24×7 to protect people from the outrage of COVID 19. But they are regularly facing problems in performing their duties which many a times escape to be noticed properly in society or may be sometimes it is willfully done so and many other causes might be there. Whatever might be the reason, one thing is clear to us that women have to go through a lot of pain in discharging their duties. One article published on web on May 28, 2020 was so heart-felt that it needs to be shared with. It was all about the experience of a lady doctor about her monthly cycle during first day of her ICU-duty; how she had to undergo pain and discomfort without having proper protection when she was bleeding inside the PPE kit but she had no option even to use lavatory but to carry out her allotted Covid duty as nothing is allowed to take inside the ICU by the doctors and removing and rewearing the PPE kit could take more than one hour and a new kit of Courseand it would have wasted one hour of her duty time out of the six allotted hours to her and hence, she, as a doctor, choose to bleed inside the PPE kit without having any protection (Kakkar, May 28, 2020).

The other gloomy incident took place recently in Tripura, a northeastern state. A lady doctor known as Dr. S. Chakraborty reached Saheed Bhagat Singh Youth Hostel, Agartala, on july 24, 2020 along with some other covid-positive patients including infected mothers whom she

wanted to get admitted in that centre. But she faced resistance from the already admitted patients who viewed that no new patients should be admitted there as the centre was already full and lacked space. On this issue, few of the already admitted patients started abusing the doctor and one among them threw up water from his mouth on the lady doctor (Times News, Tripura Times, SHAME Covid patients spat on doc., 2020, July 26).

Conclusion and Pieces of Advice:

The above discussions help us to know about the conditions of women in India during the ongoing pandemic situation. Various reports published in newspapers and web news show that women have been more vulnerable to domestic violence during the phases of lockdown in India. Women working as Covid warriors have also been passing through different types of violations of their rights and dignity of them have been affected as well. It is thus once again proved that in any crisis situation, women become the primary victims. It is really tough for the government alone to provide immediate protection to the victims but the government along with various national and state level machineries and civil society groups may come forward to protect the rights of women; ensure their dignity and give them protection both in families and their work places. Some measures may be followed in such cases like the government may take up initiative for declaring special packages exclusively for women in which they can get cash in hand, which may give them psychological relief and help them economically as well particularly those who losing their earning sources due to the existing pandemic situation. Women should be encouraged and given opportunities to participate in the decision-making process of that particular sector in which women as Covid-warriors are affected. NGOs, civil societies may take proper steps towards counselling and sensitizing both men and women in the family regarding the sharing of domestic chores. Government should take proper initiatives to extend help and security to the frontline worriers; be it in their working place or in their families. Lastly, each and every State Commission for Women and NGOs should come up with measures to provide immediate solution to the registered complaints. Apart from helpline numbers other initiative using digital platform may also be developed and awareness can be generated about the same in society by the concerned bodies / Institutions.

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Environmental Conflict Resolution: A Gandhian Perspective

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Abstract

Environmental pollution is now recognized as a serious global problem. It is causing severe environmental disasters in many parts of the world every now and then. Such environmental issues are now assumed to be a part of widened concept of security and play a rapidly increasing role in causing violent conflicts. An effective environmental administration at global, national and local level has become the most urgent need of the hour to save all living creatures and make the earth a live able place without further endangering the environment. The objective of the paper is to draw the attention of the academicians and environmental experts to review the existing mechanisms of environmental governance and to initiate debates, dialogues and directions of thinking about politico-administrative reforms for evolving an environmental state structure to the pursuit of 'good life' from Gandhian perspective.

Key Words: Anthropocentrism, environmental conflicts and conflict resolution, sustainable development, cosmic laws, law of species, mind training, self realization.

Introduction:

Conflicts are natural and inevitable parts of our life. There are societal conflicts or group conflicts, conflicts between countries, within families and other organizations. The progress and stability of society, family/organizations and bilateral relations between countries depend on how conflicts are viewed and how they are addressed. Thus, conflict resolution has emerged as an important branch of social sciences that involves the techniques and strategies to resolve conflicts including environmental conflicts between countries and different interest groups.

Environmental Conflicts and Its Social Impacts:

What is an environmental conflict? How does environmental degradation lead to violent conflicts?

According to Environment and Conflicts Project (ENCOP), "Environmental conflicts manifest themselves as political, social, economic, ethnic, religious or territorial conflicts over resources or territorial conflicts, or conflicts over resources or national interests, or any other type of conflict. They are traditional conflict induced by an environmental degradation. Environmental conflicts are characterized by degradation in one of the following fields: (i) overuse of renewable resources; (ii) overstrain of the environment's sink capacity (pollution); (iii) impoverishment of the living space."[1]

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In the words of Toronto Group, headed by Thomas Homer Dixon, "Environmental conflicts are violent conflicts that are caused by environmental scarcity in interaction with a variety often situation specific, contextual factors. Environmental scarcity appears in three forms: (i) demand induced scarcity caused by population growth (ii) supply induced scarcity due to degradation or depletion of certain resources and (iii) structural scarcity arising from the unequal distribution of, or access to, resources."[2]

Both these definitions provided explanation about casual relationship between the environment and the violent conflicts. Robert Kaplan in his 1994 Atlantic Monthly article, *The Coming Anarchy* also explained how environmental issues such as increasing populations, spreading disease, deforestation and soil erosion, water depletion, air pollution, rising sea level etc would prompt mass migration that would, in turn, incite group conflicts and how that would figure as the core foreign policy challenge in the 21st century.[3] Thomas Homer Dixon in his article, *On the Threshold* provided an analytical explanation on social implications environmental degradation. According to him, it decreases agricultural production and. causes general economic decline and population displacements and disruption of institutions and social relations.[4] Environmental degradation ignited centre-periphery conflicts around large scale development projects such as dams or irrigation schemes. Narmada Bachao Andolan in India and Chittagong Hill Tracts Political Crisis (Bangladesh) are two examples of this kind of centre periphery environmental conflicts. It caused ethno-political conflicts over the question of resource use in many countries like Sudan where the ecological degradation largely precipitated civil war in 1950s along ethno-religious line between Muslims and Christians, or Arabs and Africans[5], in Assam and Tripura in the Northeast where India experienced ethnic insurgency and ethno political conflicts on the question of land and scare natural resources. It also generated internal and cross border migration, international water conflicts over the river basins crossing national boundaries and global environmental conflicts on international management of global environmental problems such as global warming and climate change.

Anthropocentrism and Environmental Degradation:

Till the beginning of 1970s, policy makers did not attach much importance on environmental security. The relations between human beings and the environment was explained and measured primarily in the context of anthropocentrism which believed that human beings were the most important entity in the universe. It glorified supremacy of human beings over non human world.[6]Based on this understanding; the nature was exploited beyond human needs without taking care of environmental consequences. Rachel Carson in his *Silent Spring* explained how pesticides such as DDT, aldrin were used for food web commercial farming to maximize crops yields and profit causing environmental and health impact.[7] Around the same time, Stanford ecologists Paul R Ehrlich and Anne Ehrlich in the book, the *Population Bomb*, explained ecological implications of uncontrolled population explosion and warned how the growth of human population was threatening the visibility of planetary life support system.[8]Similarly, Dennis Meadows, *the Limits to Growth* summed up the emerging concerns of environmental pollution and urged for basic change of values ad goals at individual,

national and international levels.[9] The philosophy of anthropocentrism encouraged unrestricted industrialization and consumerism exacerbating the environmental problem.

View of Conflicts and Perspective of Environmental Conflict Resolutions:

Generally, there are three major views of conflicts in organizations such as (i) traditional view, (ii) human relations view (managed view) and (iii) interactionist view.

Traditionally conflicts have been perceived as negative, harmful, and wasteful. Hence, traditional view argues for avoidance of conflicts for progress of any organization[10] and favours authoritative approach to deal with conflicts and undermines the root cause of the conflicts.[11]

According to human relations view, conflict is natural and inevitable in an organization. A conflict has the potential to have a positive impact on the performance of an organization.[12] Moreover, conflict cannot be totally eradicated. Therefore, instead of suppressing or attempting to eliminate conflict totally, it must be accepted and managed effectively.

On the other hand, interactionist view encourages conflicts as mandatory for an organization's better performance arguing that if there is no conflict, the organization may become stagnant, lethargic and non-responsive to the needs for change and improvement.[13]

The early attempts to address environmental conflicts were based on the traditional view. The dominant party in such conflicts imposed its coercive view on the opponent undermining the root cause of the conflicts. The scope of application of the human relations and the interactionist view in environmental conflict resolution was very limited when environmental understanding was primarily based anthropocentrism. Its theoretical basis was either realist paradigm where the outcome is dependent on relative power or liberalism/ neo liberalism which talks about promotion of cooperation (Robert Keohane: *The possibility of cumulative Progress,* Francis Fukuyama: *The End of History and the Last Man, 1992,* Immanuel Kant: *Perpetual Peace with Republican System*). When cooperative mechanism failed; liberal/ neo liberal approach retained the scope of using coercive power. The United Nations Environmental Program (UNEP), an outcome of liberal approach, has been undoubtedly successful in building international understanding and cooperative management on ozone depleting substances through Vienna Convention, 1985 and Montreal Protocol, Basel Convention, 1989 on trans-boundary movement of hazardous wastes and bio-diversity convention for sustainable use of bio resources. The United Nations published the Brundtland Commission's Report, *Our Common Future* in 1987on sustainability and defined sustainable development as development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.[14] The report argued that "...the 'environment' is where we live and 'development' is what we all do in attempting to improve our lot within that abode. The two are inseperable".[15] The Earth Summit held in Rio de Janeiro, Brazil from June 3-14, 1992 also contributed to development of international understanding on reducing the threat of global warming and preserving the Earth's biological diversity. Similarly the OECD countries in a Ministerial Council meeting held in June 2009 decided to adopt green growth, a sustainable development strategy, to bring together

economic, environmental technological, financial and developmental aspects into a comprehensive framework. The ASEAN Summit in Hanoi held in April 2010 also affirmed its determination to promote green growth.[16]

However, despite greater emphasis on the links between environment and development, real progress towards sustainable development has not been remarkable. There is still either absence or lack of adequate focus on environmental issues, population growth, poverty and unsustainable use of natural resources. Instead, significant disagreement persisted and continues to persist on international agreements among the developing and developed nations and among the developed nations for combating against global warming and climate change. The Kyoto Protocol of 1997 is a notable example in this regard. The protocol could not become effective due to opposition of the US Senate to ratify it arguing that it would harm the US's economic interests. Similarly, the prospect of the Paris agreement on climate change of 2016 also remains at hang due to Donald Trump's (the US President) firm determination to withdraw the US from the agreement.

Integrationist method of conflict resolution does not find any place under anthropocentrism that attaches domination of the human world over the non human worlds. It is associated with the traditional view of conflict. Environmental negotiations under realist and liberal/ neo liberal paradigms and traditional view of conflicts are bound to be juxtaposed with anthropocentrism. As a result, despite efforts to address environmental problems, unrestricted use of natural resources, agriculture with excessive use of pesticides and fertilizers, industrial and mining activities without taking care of the environment continue unabated. The issue of healthy survival of all species on this planet is still a very big challenge. In this connection, it is important to analyse importance of Gandhiji's views on environment and his philosophy of conflict resolution based on truth and non-violence.

Mahatma Gandhi and Environmental Conflict Resolution:

Theoretically Gandhi was not a conventional environmentalist. He had neither created a green philosophy nor did he write nature poems. Yet he was often described as an "apostle of applied human ecology".[17] According to Ramachadra Guha, an eminent environmental writer, Gandhiji was definitely an early environmentalist.[18] What made him to be an environmentalist? Unlike conventional environmentalist, Gandhi did not take part in environment movement but his simple lifestyle and ideas about development help us to explain about his environmental concerns and provide a perspective to understand about his ideas on sustainable development and how such ideas are linked with integrationist method of environmental conflict resolutions. According to him, nature has abundance to satisfy every one's needs but not to satisfy every one's greed which ultimately became one line ethic to modern environmentalism. His environmental ideas can be futher explained from two fundamental laws (i) Cosmic laws and (ii) Law of species. Cosmic laws defined the entire world as a single entity that includes both the living and non living phenomenon[19] with the "universe being structured and informed by the cosmic spirit that advocated all life and creations as one.[20] Under the law of species, Gandhi argued for cooperation and sacrifice of both human and non human beings without which evolution was not possible. Therefore, human beings as the custodian of the rest of creation must respect the rights of the non human

world and help in cherishing their diversity. For this reason, Gandhi considered any attempt of taking more than the required resources as theft.[21] Therefore, according to Gandhi; rich must not exploit the nature beyond their wants and treat their wealth as a "trust" for the poor and use it for the welfare of the poor. Such an attempt would not only help the unprivileged of today, but would also protect the environment for the generation.[22] His life was his message in environmentalism. He and his wife gave away all their property, had nothing beyond the clothes they wore and a change or two and very consciously used only the minimum water from the free flowing Sabarmati river for taking bath. It appears that Gandhian idea of development touched -social, economic and environment aspects- the three important pillars of sustainable development.

Sometime, Gandhi was criticized for his strong anti rhetoric against modern civilization as 'satanic'. However, he was not against technology but against technologism that created a hierarchical relationship between/among men and between man and nature as well. According to Gandhi, the greatest achievement of the modern civilization is the development of weapons of mass destruction, awful growth of anarchism, and cruelty that has been inflicted on the innocent, dump and living animals in the name of science and technology. He argued that science must afford the fullest scope for satisfying the hunger of the body, mind and soul. But, modern scientific civilization that involved an egregious amount of violence had undermined men's unity with his environment killing or torturing animals and ruthlessly exploiting natural resources for unrestricted human needs.[23] It increased unsatisfied human desire resulting into increasing imbalance, environmental degradation, fast vanishing flora and fauna, explosion of human population. However, according to Gandhi, human life depends much on ecological balance and environmental quality. Therefore, science must afford the fullest scope for satisfying the hunger of the body, mind and soul. Modern scientific technology must be used to institutionalize representative and accommodative environmental governance and peaceful environmental conflict resolutions.

According to Gandhi, violence and counter violence never helps to resolve conflicts. Satyagraha based on truth and non violence is an effective instrument to fight against environmental injustices and marginalization. For Gandhi, truth is one and without self realization, it is not possible to realize the truth and lead a non coercive life. Self realization trains and controls our mind to be humble and free us from all ill desires, lust for power and developing hatred towards others. It is self realization that leads us to refrain from violence, miscalculation and misadventure against others. Thus, Satyagraha offers no scope for hatred but offers to be one's nearest and dearest and to lead an eco friendly human life.[24]

Conclusion:

With the philosophy of Satyagraha, Gandhi contributed to the integrationist and interactionist view of conflict resolution. Like Gandhi, thinkers like Chester Bernard (organization as cooperative social system), Mary Parker Follett (integrationist method of conflict resolution), Rensis Linkert (democrative participative management), and Karl Marx (classless society), who had contributed to the integrationist method of conflict resolution. But, Gandhi is different from them. Like Marx, Gandhi did not favour application of any form of violence. Similarly, unlike Gandhi, Waldo and Follett did not realize that true integration would not

happen without changing our behavioral attitudes and becoming ethically responsible towards the environment. It was Gandhi who argued for such behavioural changes towards the environment. This change is linked to self realization about the truth and making our mind positive and self disciplined. Training of mind would only lead us to be humble, free us from any ill desires and developing hatred towards others. Gandhi's philosophy of Satygraha and idea of self realization is an alternative to anthropocentrism, realism and neo-liberalism for achievement of the goals of sustainable development. It is one of the best examples of integrationist method of conflict resolution.

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