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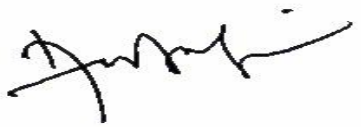
Editorial Board

Message From Editor–in–Chief

This is the fifth issue of the City University Journal; December 2020 which consists of ten articles contributed by the faculty members of City University as well as outside researchers specialized in their subject areas.

The Editor-in-Chief would like to express his heartfelt thanks to the contributors and reviewers of the articles who made their best effort to develop knowledge based approach in the field of researches in Arts, Social Sciences, Engineering Sciences and Business Administration.

We hope that the Journal will be able to attract more Research Scholars, University Teachers and Civil Society Members as before in the years to come.



(Professor Mustafizur Rahman)
Editor-in-Chief
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A Study of Comparing Total Population of Bangladesh with Age-Structured Linear Sharpe-Lotka Model and Malthusian Model.

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Abstract

We consider an age-structured linear continuous population model named Sharpe-Lotka model, incorporating an factor contributes to limiting effect which may be occur due to lack of resources. This factor depends on the whole population rather than on any specific age group. In our paper, we investigate the total population size of Malthusian model and Sharpe-Lotka model for some specific age group & compare our investigated solutions with the total population of Bangladesh by using numerical method "Newton's backward interpolation formula".

Keywords : *Sharpe-Lotka model; Malthusian model; age-structured population model*

1. Introduction

An analysis of the earliest population models developed were proposed by [1] in 1798 and then by Verhulst in 1838.These models are unstructured and so ignore the properties of individuals and in particular ageing of individuals is not taken into account. Hence they consider only the total number of individuals in the population. The limitation of these models is that all members of the population are assumed to be equally likely to die or to reproduce. Among the first 'continuous' population models incorporating age effects were those of [2, 3]. Basically, the Sharpe-Lotka-McKendrick model assumes that birth and mortality processes are linear functions of population density. In [4] used discrete age compartments (giving rise to Leslie matrices) and in [5] used both discrete time and age compartments. In [6] and [7] introduced the first models of nonlinear continuous age-dependent Population dynamics. In [8] considered age-structured disease models but with nonlinear terms in the disease-transmission formulation. Here we consider the effect of overall population density on the age distribution as suggested by [9].In our present paper, population of Bangladesh has been predicted with the help of an ordinary differential equation model known as Malthusian model which is parameterized by growth rate along with

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specific age group and also predicted with the help of linear continuous Sharpe-Lotka population model. We use "Newton's Backward Interpolation" scheme for the numerical solution. First we consider different types of data table using [10] which are depend on the specific age groups and then we find our population projection which is very good fit with the actual data. After that we also investigate population projection of Bangladesh with the help of Malthusian model and Sharpe-Lotka model using same data table.

2. Structure

Let $\boldsymbol{x(t,a)}$ be the population density (or age- distribution) with respect to age $\boldsymbol{a}$ at time $\boldsymbol{t}$. Let,

$\boldsymbol{\vartheta(a)}$ = An age dependent birth rate.

$\boldsymbol{\mu(a)}$ = An age dependent death rate.

$\mu(a)x(t,a)dt =$ number of the population of age a that dies in the small increment of time dt.

$x(t,a)\Delta a =$ Number of individuals with age between a and $a+\Delta a$ at time t.

$\sum x(t,a)\Delta a$ =total population at time t.

$\sum x(t,a)\Delta a \to \int_0^\infty x(t,a)da as\ \Delta a \to 0 \therefore$

$x(t) = \int_0^\infty x(t,a)da$is the total population.

Note that, $x(t,a) = 0$ for all sufficiently large a, so that the above integration is not necessarily an infinite integral. We assume that members leave the population only through death and that there is an age dependent death rate$\mu(a)$.

$\mu(a)\Delta t$=denote the fraction of the individuals die over the interval from t to $t+\Delta t$ with ages between a and $a+\Delta t$ at time t. So $x(t,a)\Delta a\mu(a)\Delta t$ denote the number of deaths between the time t and $t+\Delta t$ with ages between a and $a+\Delta a$ and the remaining ages between $a+\Delta t$ and $a+\Delta t+\Delta a$ at time Δt .

$$\therefore x(t+\Delta t, a+\Delta t)\Delta a \approx x(t,a)\Delta a - x(t,a)\mu(a)\Delta a\Delta t \qquad (1)$$

Dividing (1) by$\Delta a\Delta t$, we get

$$\frac{x(t+\Delta t,a+\Delta t)\Delta a}{\Delta a\Delta t} - \frac{x(t,a)\Delta a}{\Delta a\Delta t} + \frac{x(t,a)\mu(a)\Delta a\Delta t}{\Delta a\Delta t} = 0$$

$$\Rightarrow \frac{x(t+\Delta t,a+\Delta t)}{\Delta t} - \frac{x(t,a)}{\Delta t} + x(t,a)\mu(a) = 0$$

$$\Rightarrow \frac{x(t+\Delta t,a+\Delta t)-x(t,a)}{\Delta t} + x(t,a)\mu(a) = 0$$

(*2*)

Let $\Delta t \longrightarrow 0$ and $x(t,a)$ is a differentiable function of a and t, then we have

$$\lim_{\Delta t\to 0}\frac{x(t+\Delta t,a+\Delta t)-x(t,a)}{\Delta t}$$

$$= \lim_{\Delta t\to 0}\frac{x(t+\Delta t,a+\Delta t)-x(t+\Delta t,a)}{\Delta t} + \lim_{\Delta t\to 0}\frac{x(t+\Delta t,a)-x(t,a)}{\Delta t}$$

$$= \lim_{\Delta t\to 0} x_a(t+\Delta t,a) + x_t(t,a)$$

$$= x_a(t,a) + x_t(t,a)$$

$$= \frac{\partial x(t,a)}{\partial a} + \frac{\partial x(t,a)}{\partial t}$$

$= D_e x(t,a)$, where $D_e x(t,a)$ is a directional derivative of x.

$$\therefore D_e x(t,a) = \frac{\partial x}{\partial a} + \frac{\partial x}{\partial t} \qquad (3)$$

Now from (2) we have

$$D_e x(t,a) + x(t,a)\mu(a) = 0$$

$$\Rightarrow x_a(t,a) + x_t(t,a) + x(t,a)\mu(a) = 0$$

(*4*)

This is called the Von Foerster equation and more rapidly called the McKendrick equation. Equation (4) is a first order partial differential equation which requires condition on $x(t,a)$ in t and$a$.
Initial condition of the Model is $x(0,a) = \varphi(a)$ (5)

The population at time $t = 0$ has a given age distribution $\varphi(a)$. When birth rate is $x(t,0)$, then there can be no births of age $a > 0$. The boundary condition on a comes from the birth rate and is

$x(t,0) = \int_0^\infty \vartheta(a)x(t,a)$ (6)

Where birth rate $\vartheta(a)$ of course will tend to zero for large$a$, and birth rate $\vartheta(a)$ only appears in the integral equation (6), not in the differential equation (4). Equation (4) is called Von Foerster equation. The birth rate and death rate $\vartheta(a)$ and $\mu(a)$ affect the growth of the population after a long time. In order to complete the model we must specify an initial age distribution (at time zero).Thus the full model is

$$x_a(t,a) + x_t(t,a) + x(t,a)\mu(a) = 0$$
$$x(t,0) = \int_0^\infty \vartheta(a)x(t,a)da$$
$$x(0,a) = \varphi(a)$$

The renewal equation for Sharpe-Lotka model is $B(t) = \psi(t) + \int_0^t \vartheta(a)B(t-a)e^{-\int_0^a \mu(\alpha)\,d\alpha}\,da$ (7)

Thus, we may evaluate ψ in terms of the birth and death moduli and the initial age distribution.

$$\psi(t) = \int_t^\infty \vartheta\varphi(a-t)e^{-\int_{a-t}^a \mu(\alpha)d\alpha}da$$

$$= \int_0^\infty \vartheta\varphi(s)e^{-\int_s^{s+t}\mu(\alpha)d\alpha}ds$$

$$= \int_0^\infty \vartheta\varphi(s)e^{-\mu t}ds$$

$= \vartheta e^{-\mu t}$ [We assume $\int_0^\infty \varphi(s)ds = 1$]

Also$\vartheta e^{-\int_0^a \mu(\alpha)d\alpha} = \vartheta e^{-\mu a}$

From (7) we have $B(t) = \vartheta e^{-\mu t} + \vartheta\int_0^t e^{-\mu a}B(t-a)da$

$$= \vartheta e^{-\mu t} + \vartheta\int_0^t e^{-\mu(t-s)}\,B(s)ds$$

$$= \vartheta e^{-\mu t} + \vartheta e^{-\mu t}\int_0^t e^{\mu s}B(s)ds$$

Differentiation gives $B'(t) = -\mu\vartheta e^{-\mu t} + \vartheta e^{-\mu t}e^{\mu t}B(t) - \vartheta\mu e^{-\mu t}\int_0^t e^{\mu s}B(s)ds$

$$= -\mu\left(\vartheta e^{-\mu t} + \vartheta e^{-\mu t}\int_0^t e^{\mu s}B(s)ds\right) + \vartheta B(t)$$

$$= -\mu B(t) + \vartheta B(t)$$
$$= (\vartheta - \mu)B(t)$$

From the renewal equation with $t = 0$ we see that $B(0) = \vartheta$. Now $B'(t) = (\vartheta-\mu)B(t)$, $B(0) = \vartheta$ implies$B(t) = \vartheta e^{(\vartheta-\mu)t}$, and this gives the age distribution function

$$x(t,a) = \begin{cases} \vartheta e^{(\vartheta-\mu)(t-a)-\mu a} for\, t \geq a \\ \varphi(a-t)e^{-\mu t} for\, t < a \end{cases}$$
(8)

The total population size $P(t) = e^{(\vartheta-\mu)t}$ (9)

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Table 1: Women aged 15-39 years and over by age group and children died after birth, 2011

Age	Number Of women		Children died after birth						
			Total	%	Bangladesh	Sharpe-Lotka	Malthusian	Error-01	Error-02
15-19	6108871		34758	.568	.71	.77	4.19	.0845	4.9
20-24	6613990		307515	4.64	18.5	22.90	93.19	.2370	3.99
25-29	6957607		767016	11.02	154.28	166.00	600.57	.0759	2.89
30-34	5107978		911809	17.85	767.5	779.66	2641.75	.0158	2.44
35-39	5072599		1290484	25.44	3129.12	3146.35	10247.09	.0055	2.27

Table 2: Women aged 15-44 years that gave birth in the last 12 months and children born alive in the last 12 months and died, 2011

Age	Number Of women	Children born alive in the last 12 months and died						
		Total	%	Bangladesh	Sharpe-Lotka	Malthusian	Error-01	Error-02
15-19	6108871	7927	.129	.174	.175	.95	.0005	4.45
20-24	6613990	33743	.510	2.448	2.512	10.24	.0261	3.18
25-29	6957607	27187	.390	5.65	5.875	21.29	.0361	2.76
30-34	5107978	13182	.258	10.58	11.26	38.29	.0642	2.61
35-39	5072599	8383	.1652	19.96	20.40	66.56	.0220	2.33

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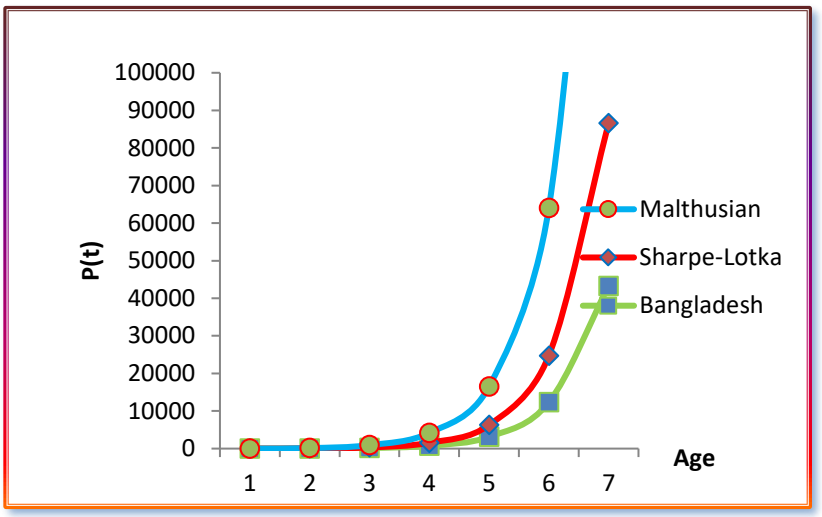

Figure 1: Women aged 15-39 years and over by age group and children died after birth, 2011

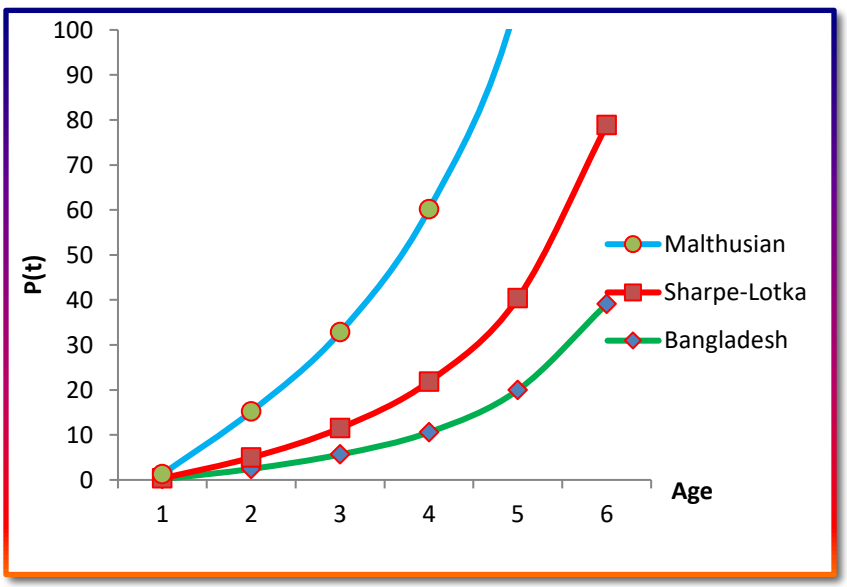

Figure 2 : Women aged 15-44 years that gave birth in the last 12 months and children born alive in the last 12 months and died, 2011

Discussion

The significant effect of Malthusian model & Sharpe-Lotka model with Bangladesh population curve is shown in figure1 & figure 2. Population curves doesn't coincide with each other. Figure 1 & figure 2 indicates that Malthusian model population curve is more exponential than Sharpe – Lotka model population curve and Sharpe – Lotka model population curve is more exponential than Bangladesh population curve. In figure 1 difference between Bangladesh P(t) curve & Malthusian P(t) curve is 2.18 % where as Sharpe-Lotka curve shows .0052 % difference with Bangladesh P(t) curve at highest age range. Figure-2 Shows The difference between Bangladesh P (t) curve & Malthusian P(t) curve is 2.22 % where as Sharpe-Lotka curve shows .0168 % difference with Bangladesh P(t) curve at highest age range.

Conclusions

After analyzing the above cases we come to the conclusions that Malthusian model and Sharpe-Lotka model shows more exponential result and these two models are not appropriate for assuming growth of population of Bangladesh.

Recommendations

Malthusian model makes some recommendations concerning agricultural, labor, manufacturing policies, personal restraint, and public assistance policies. At the same time Sharpe Lotka model has importance to analyze population dynamics of different types of pests in the agricultural field.

References

[1] T. R. Malthus.An essay on the principle of population and a summary view of the principle of Population. England,Harmondsworth :Penguin, 1970.

[**2**] F. R. Sharpe and A. J. Lotka."A problem in age distributions". Phil. Magazine, vol.21, pp. 435-438, 1911.

[3] A. G. McKendrick. "Applications of mathematics to medical problems ,"inProc. Edinburgh Math.Soc., 1926,pp. 98-130.

[4] P. H. Leslie. "Some further notes on the use of matrices in population mathematics."Biometrika, vol.35, pp. 213-245, 1949.

[5] P.H. Leslie. "On the use of matrices in certain population mathematics."Biometrika, vol.33, pp 183-212, 1945.

[6]M.E.Gurtin and R. C. MacCamy."Non-linear age-dependent population dynamics."Arch. Ration. Mech. Anal., vol.5, pp 281-300, 1974.

[7] F.C.Hoppensteadt. "Mathematical theories of populations: demographics, genetics and epidemics." Soc. Industr. Appl. Math., 1975.

[8] G. C. Wake, K. Louie and M. G. Roberts."The regulation of an age-structured population by a fatal disease with or without dispersion." in Proc. of Claremont

internationalconference dedicated to the memory of Stravos Busenberg, World Scientific, Singapore, pp.553-563, june 1-4, 1994.

[9] Norhayati & G.C. Wake. "The solution and stability of a non-linear age-structured population model."ANZIAM J., vol. 45, pp. 153-165, 2003

[10] Population and Housing Census, Socio-Economic and demographic report, National series, vol. 4, 2011.

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Cancer Registry Importance in Bangladesh: A Review and A Mobile Application Based Solution

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Abstract

In recent times, cancer becomes the major health issue. Cancer registry is challenging but a part of modern health care that creates awareness globally. Time has come, when Bangladesh has to give supreme priority to make a smart system for cancer registration to collect and manage proper database of the number of cancer patient, survivor rate, death rate and chronic condition for future analysis. . This review has twofold goals, first is propose an effective solution through a mobile app for cancer registry and second is suggest a efficacious method for cancer registration by exploring the cancer registry methods are available in journal articles. The increasing number of smart mobile phone user is immensely helping us in this purpose. In this paper two types of methods are used for cancer registry, one is community clinic based registry approach another is hospital based registry approach. Community clinic is the unique innovation in Bangladesh health care system, and this community clinic based cancer registry is first time going to be implemented through this paper. Base on reviewing the features of apps and surveying on 100 of people including doctors, cancer patients and CHCP, we become able to propose an app of cancer registry. Apps were collected from August 2018 to March 2019 and data was analyzed in April 2019.

Keywords*:* Cancer registry; mobile application; incidence; community clinic; health care.

I. Introduction

Day by day worldwide cancer incidence and mortality rate is increasing. Most of the country's leading cause of death and physical or mental disability is cancer[1].So, it's become obvious to collect proper data to analyze the causes of cancer, duly. There are several ways and methods of cancer survey. Population and hospital based survey is most common where population based survey can be done in several ways. Cancer registry is the best way to collect exact database of cancer patients but that is not soundly organized in most of the third world countries. Because of those countries are not aware to develop proper cancer registry system and process. Generally, this registry includes cancer incidence rates, death rates and survival rates where there is no such kind of information or data that can be used for prepare a plan of prevention, control or cure process of cancer.

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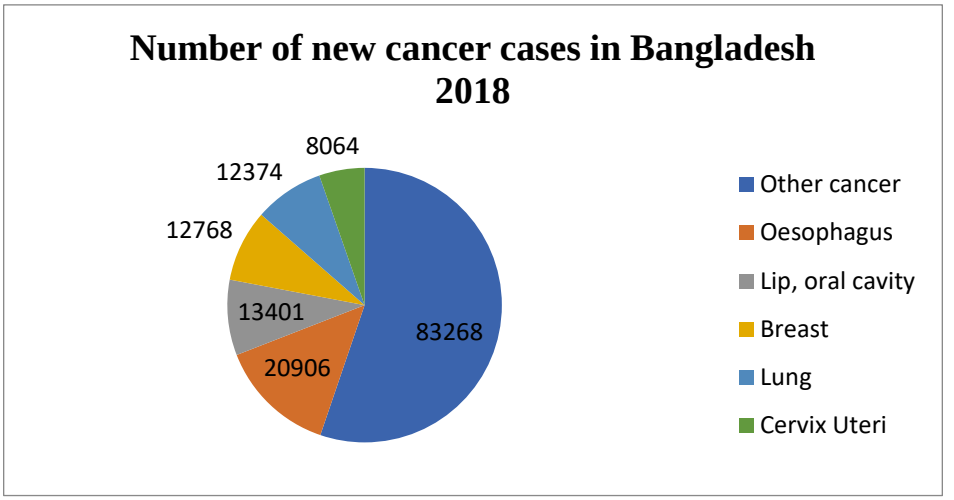

Figure 01: Newly diagnosed cancer cases in Bangladesh 2018[19].

According to graph only in the year 2018, 1,50,781 cancer cases are recorded but this is not the exact figure. Cancer predicted as an important cause of death in few decades and in coming years the rate will increase at a significant rate [18]. It pretends the necessity for proper cancer registry in Bangladesh
both in national and community level for further research to make a national cancer control plan.

In present era Information and Computer Technology (ICT) give emphasis on technology based solution. World is now in grip of hand only because of the technology. Smart phone provides easy web browsing, social networking, data storage facilities and many more especially apps for different purpose. In health care, mobile phone technology contributes a lot. This review helps us to analyze the articles and existing mobile apps that are currently available. Most of the features are not effective according to user's demand.

In Bangladesh cancer registry system is unorganized. However we need a registry system in the perspective of Bangladesh. That's why here we try to merge app features with cancer registry method. Primary goal of this study is to make a comparison among all effective methods and establish a best form of solution in perspective of Bangladesh. We try to combined two types of registry methods through mobile application. One of the methods is community clinic-based registry that will be done by community clinic CHCP, this part is only for rural people because in most the cases we have found that the rural people are unaware about cancer screening In urban areas, people's cancer registry can be performed by hospital based registry. In this paper we will focus on health care mobile apps base on above two methods which also include cancer screening. We target mobile application because of the increasing number of smart phone users, and now smart phone becomes a part of our daily life.

I. Literature Review

Population based registry method will be effective if all data are properly recorded[9] according to our requirements. A paper illustrates population based survey to estimate the percentage of cancer suffering people in China and Ukraine[1]. In the whole world only china contains one fifth of total population[2][7].From different sources, they collected data like cancer incidence and mortality that was compiled by 72 local cancer registries to estimate the number of death patients and cancer survivals.[13]In china there are many other additional numbers of population based registry methods are available [1].But all off the registries have no sufficient high quality data formats that can provide expected information[11][12].Another paper also apply population based survey but in different way, basically base on different methods they analyze data of particular time in UK for cancer registry[3][4]. They include 4980 participants in this study and record their response through some categories. The categories are cancer survivors, cancer survivor with no chronic condition, cancer survivor with one chronic condition, cancer survivor with two or more chronic conditions and healthy participants. These categories have some sub category sex, nation, household structure, carrier structure, type of interview and age. Here they try to map categories with sub categories. Cancer survival rate is very lower in low income countries and comparatively higher in middle income countries[5]. Another problem in low and middle-income country's people are not health conscious, they are not well known with symptoms. That why early detection of cancer is not possible. In their paper they focus the ratio of cancer mortality rate among high income, higher middle income, low income and lower middle income by cancer types. Cancer registry data widely used for monitoring and evaluate screening program in a wide range[7].This paper focus on cancer control terminology that encompasses all elements of prevention, early detection, treatment, rehabilitation and palliation. Cancer registry data is widely used to monitor and evaluate for screening program in a wide range. Screening is a scientific way of cancer detection for improved cancer survival. Study of another method shows author research on data those are related to HPV (Human papilloma virus) associated cancer[8]. They find association with six cancer sites (cervical, vulvar, vaginal, anal, penile and oral) all are considered to have sufficient evidence of HPV association. This paper's surveying approach was also a population-based survey but in different way.

Five organ-based cancer registry using hospital data is another approach of survey, implement in Japan. This paper highlights on five organs those are attacked by cancer cell frequently (breast, lung, stomach, cervix and colorectum) [6].Researcher in their paper used hospital based cancer registry data that was collected from different hospital from 2007 to 2013[6]. They had collected several numbers of case history data and make a report on organ-based cancer detection. The best part of their paper is, they discuss on cancer in two ways symptomatic and asymptomatic. Result of this study is proportion of symptomatic cases progression is increased more than asymptomatic cases. Cancer may symptomatic or asymptomatic but asymptomatic patients tended to be diagnosed earlier than symptomatic patients. Another hospital based registry focus on ovarian cancer registry and postulate cancer registry[15][16].

A population based survey[14] executes to estimate the rate of cancer survivors. Main problem of this study is it was an online and telephone based survey. The way of approach may not fully appropriate to represent cancer survivor.

By studying a paper on population based survey we come to know that breast cancer is very common type of cancer[10] in Bangladesh specially for women. And they suggested strongly the population based survey is the best approach to find exact figure of breast cancer patients.

After reviewing of different articles, it is clear that population-based survey approach mostly used and popular approach for cancer registry where some country follows hospital-based registry. But we didn't find any complete solution and ultimate result is not much efficacious.

Journal	Population based registry	Hospital based registry	Community clinic base registry	Registry through App
Cancer Statistics in China, 2016[2]	Yes	No	No	No
The health and well-being of cancer survivors in the UK[3]	Yes	No	No	No
How asymptomatic are early cancer patients of five organs based on registry data in Japan[6]	No	Yes	No	No
Using Population-based Cancer Registry Data to Assess the Burden of Human Papilloma virus-associated[8]	Yes	No	No	No
Hereditary association between testicular cancer and familial ovarian cancer [15]	Yes	No	No	No
Bladder cancer incidence and mortality[4]	Yes	No	No	No
Epidemiology of breast cancer among the female patients in Bangladesh [11]	No	Yes	No	No
Incidence of Primary breast cancer in Iran[13]	Yes	No	No	No
Awareness of Breast cancer and Barriers to breast Screen in gup take in Bangladesh [18]	Yes	No	No	No
Association of BRCA1, BRCA2, RAD51, and HER2 gene polymorphisms with the breast cancer risk in the Bangladeshi population. [19]	No	No	No	No
**Cancer registry Bangladesh: A review a apps based solution.				Yes

Table 1: Summary of Cancer Registry Journals

Method

A. Search method

We search by using keyword 'cancer registry', 'mHealth' , 'cancer registry method' and 'cancer incidence' for journal and 'cancer app', 'cancer registry app' for mobile application.

B. Data collection

Data have been collected from survey and literature review. Apps features have been collected from

doctors, DHCP and patient verbal explanation as well as by analysis of downloaded apps features from Google. We went to hospital and talk with doctors. Consulting with ten specialists and discussing about existing cancer registry, we also share our idea with them. We received their feedback for our future help. Community health center CHCP is also a part of our survey where 20 skilled CHCP took part on our survey.

Our discussion goal was to make a app for all doctors, CHCPs and patients. The patient participation and their opinion are also important. Near about 50 patients age range (25-40) were participated in this survey. Duplicate participant data have been excluded.

C. Selection criteria

We put some selection criteria to choose Apps and journal for literature review. We choose informative and reputed journals as well as excluded Journals which are published before 2008. We choose those Apps that have some good features like cancer types, symptoms, patient daily improvement registry, medicine notification etc.

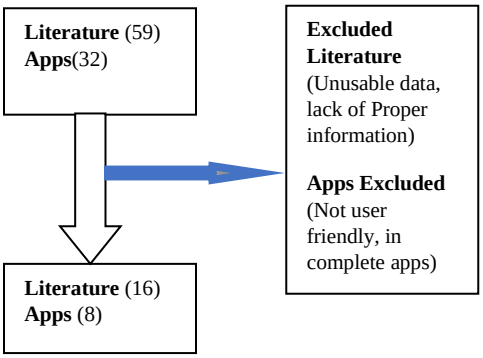

Figure 02: Selection process for articles from journal and Apps.

II. Result analysis and discussion

According to findings of all papers include only the population-based survey or hospital-based survey with different aspects we found that they don't use any kinds of digital technology. My proposed model is a mapping of combination of hospital and community clinic-based registry by a mobile app. Total 100 participants join in this phase. Most of the patients and doctors prefer our app features as a part of cancer registry. We have discussed with them about app features and observed positive reaction about our apps.

Table 2 Summary of features from the downloaded apps

App Name	User		Features	Types of App				
	Patient	Doctor		Registry	Patient Information	Cancer Manual	Cancer Screening	Other's
Cancer.net	Y		Types of cancer, cancer symptom, question			Y		
TNM cancer staging manual	Y		Cancer stage, table index, ICD index, image index.			Y		
Cancer Aid	Y		Add cancer type, add champion, symptom journal, symptom log.		Y		Y	
Cancer CI			Session, catalog, exhibitor.					Y
Self-Care During cancer	Y		Start new assessment, today's symptom, symptom management		Y	Y		
SNEH cancer app	Y	Y	Consult with doctor, face to face consult, toll free consult, online consult, patient registration, doctor registration, cancer symptom, prevention.	Y	Y	Y		
PM journey	Y		Just diagnosed, during treatment, after treatment, side effects		Y			
Proposed Apps	Y	Y	Patient cancer stage all information, doctor related feature, cancer screening, cancer manual	Y	Y	Y	Y	

V. Proposed Model

More than 3000 community clinics are existing in our country. In our country 80% people lives in rural areas [18]. Lack of education and other privileges, people of rural areas are not conscious about cancer symptom. In that case community clinic can play a helpful role to get closer to the rural inhabitance. In my suggested app, all data from this app will be stored in a central database. We can verify data through image detection to prevent data redundancy. The language of this app will be both Bengali and English.

Important features of proposed app are as follows:

1) Patient verification: Patient verification is one of the most important features of this App it will help to prevent insert redundant data into the system. No patient can register him without consult a doctor or without CHCP concern.
2) Patient's information: This App will save cancer patient's all information like when cancer first diagnosed, recovery stage, chronic condition, suggested medicine, patient cancer stage information, consulted doctor name etc.
3) Cancer screening: It will help to detect cancer in an early stage. This feature designed based on ICD 10 instructions. It includes cancer types of and symptoms. If any new type cancer diagnosed there will be an option to include this.
4) Different user login: Mainly there will be 3 types of user hospital doctor (patient consulted doctor), patient and community clinic CHCP.
5) Registration through consulted Doctor: This part will cover hospital-based registry. When a cancer patient first detected, he or she must be immediately registered by hospital authority.
6) Registration through CHCP: This feature will cover community clinic-based registry. Beside this

CHCP will also refer the patient to a good cancer specialist.
7) Emergency patient doctor consult: Consult with doctor, face to face consult, toll free consult, online consult in an emergency situation.

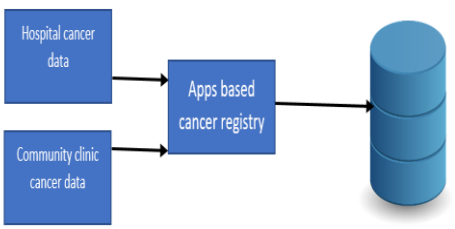

Figure 03: Overall scenario of proposed app.

VI. Limitations and Strengths

This app has no cloud base data storage support. Image detection is a tough way to implement properly. Although the data presented in this study does not cover enough doctor patient participation. Community clinic-based support and Apps supported data collaboration is the strength of this proposal.

VII. Conclusion

Cancer is one of the most common chronic disease in Bangladesh and becoming the leading cause of death. For that cancer registry become important for making a successful cancer control plan in Bangladesh. At present, Bangladesh is facing so huge challenges in diagnosing and providing proper treatments of the increasing number of cancer patients. There are near about 15 lakhs cancer patients [17]. Every year two lakhs of patient diagnosed by new types of cancer. Only cancer

diagnosis data is not enough for cancer registry, a complete package of data is required. To solve this

problem, we need a solution that suitable with perspective of Bangladesh. In rural areas, people are not registered as a cancer patient, because they are not conscious. We hope that mobile application will be able to solve this problem. With all proposed features this app will be a unique and effective one. Further work will be needed in future to carry this much more ahead.

References

[1] A. Ryzhov, F. Bray, J. Ferlay, Z. Fedorenko, and L. Goulak, "Evaluation of data quality at the National Cancer Registry of Ukraine," *Cancer Epidemiol.*, vol. 53, no. September 2017, pp. 156–165, 2018.

[2] W. Chen *et al.*, "Cancer Statistics in China," *CA Cancer J. Clin.*, vol. 66, no. April, pp. 115–132, 2016.

[3] J. Elliott *et al.*, "The health and well-being of cancer survivors in the UK: findings from a population-based survey," *Br. J. Cancer*, vol. 105, no. S1, pp. S11–S20, 2011.

[4] S. Antoni *et al.*, "Bladder Cancer Incidence and Mortality : A Global Overview and Recent Trends," *Eur. Urol.*, vol. 71, no. 1, pp. 96–108, 2017.

[5] P. Farmer *et al.*, "Expansion of cancer care and control in countries of low and middle income: A call to action," *Lancet*, vol. 376, no. 9747, pp. 1186–1193, 2010.

[6] N. Nakabayashi, M. Hirose, R. Suzuki, J. Suzumiya, and M. Igawa, "How asymptomatic are early cancer patients of five organs based on registry data in Japan," *Int. J. Clin. Oncol.*, vol. 0, no. 0, p. 0, 2018.

[7] D. M. Parkin, "Global cancer statistics in the year 2000," *Lancet Oncol.*, vol. 2, no. 9, pp. 533–543, 2001.

[8] M. Watson *et al.*, "Using population-based cancer registry data to assess the burden of human papillomavirus-associated cancers in the United States: Overview of methods," *Cancer*, vol. 113, no. 10 SUPPL., pp. 2841–2854, 2008.

[9] R. Parveen, S. S. Rahman, S. A. Sultana, and Z. H. Habib, "Cancer Types and Treatment Modalities in Patients Attending at Delta Medical College Hospital," vol. 3, no. 2, pp. 1–6, 2015.

[10] S. Parvin, S. Islam, and M. Abdullah, "polymorphisms with the breast cancer risk in the Bangladeshi population," *Breast Cancer*, 2016.

[11] S. F. Bellah, A. Salam, R. Karim, and J. Hossain, "Epidemiology of breast cancer among the female patients in Bangladesh," pp. 85–95, 2016.

[12] R. M. Islam, R. J. Bell, B. Billah, M. B. Hossain, and S. R. Davis, "Maturitas Awareness of breast cancer and barriers to breast screening uptake in Bangladesh : A population based survey," vol. 84, no. September 2013, pp. 68–74, 2016.

[13] T. International, C. Epidemiology, S. Behzad, S. Saadat, R. Ramezani, and A. Kaviani, "Incidence of primary breast cancer in Iran : Ten-year national cancer registry data report," *Cancer Epidemiol.*, 2015.

[14] J. Ferlay *et al.*, "Cancer incidence and mortality worldwide : Sources , methods and major patterns in GLOBOCAN 2012," vol. 386, 2015.

[15] J. Lewis *et al.*, "Hereditary association between testicular cancer and familial ovarian cancer : A Familial Ovarian Cancer Registry study," *Cancer Epidemiol.*, vol. 53, no. January, pp. 184–186, 2018.

[16] S. M. Evans *et al.*, "Development of an International Prostate Cancer Outcomes Registry," pp. 60–67, 2016.

[17] S. A. Hussain and R. Sullivan, "Review Article : Cancer Trends in Asia Cancer Control in Bangladesh," 2013.

[18] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3889062. Accessed May 12, 2019.

[19] https://www.dhakatribune.com/bangladesh/event/2019/02/04/world-cancer-day-2019-cancer-treatment-still-a-dream. Accessed May 19, 2019.

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Comparison of Fault Injection and Property Based Software Security Testing Technique

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Abstract- Security means the safety and it measures what we take to in order to stay protected and safe. Still some years ago, we concerned security only for our households and office environment but now-a-days another stem of security is "software security" which contains the current interest. To address this problem various techniques are taking place. Security is considered as a figure of merit of software. A secured software can easily meet its business requirement. The main aim of this paper is to discuss about two empirical software security techniques- one is Fault injection based security testing & the another type is Property based security testing. Not only this, we have also represented a basic comparison between these two techniques. For the project purpose we have also developed two software for testing these two types of techniques through which we can clearly represent that how these two techniques work to secure a software from being attacked & these two software are performing the black box testing which is very unique to verify a software is vulnerable or not.

Keywords-Software security, Fault Injection Based testing, Property Based Testing, security, Testing Technique.

I. INTRODUCTION

Reliability is considered as the valuable important term of the system quality. Reliability means that how much a system can operate a failure free operation for a specific environment and for a specific period of time [1]. Software security testing is a vital term means to ensure software security and trustiness. In this computer era, software becomes more complicated and large-scale. This results software security problems more concerning. When a software is being attacked, software security provides a big support become a big support to protect that system [2]. In this paper we have discussed about two major methods of software security testing. Weinliang Du used fault injection technique for software security testing, which established fault mode of Environment-Application Interaction, EAI. [3] [4]. Robustness testing is a type of fault injection. This type commonly used to test for vulnerabilities in communication interfaces. Fault injection technique gives concentration on the interaction points of application and environment. Not only this, it also focuses on user input, file system, network interface, and environment variable. The main idea of this testing type is to test whether the software can response correctly using various types of protocol packets. In order to discover security faults, some wrong data or bugs should be injected into various protocol packets. The main fault injection tools are CECIUM, DOCTOR, ORCHESTRA, NFTAPE, LOKI, Mendosus, OGSA, FAIL-FCI. Fault injection technique can effectively simulate a various types of unusual behavior of software. In a fault injection function, software is needed to reach a certain state,

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which is difficult by other testing technology. Another type of popular technique is property based testing. This is a technique in which test cases are automatically generated from a specified property of system.

In the next section we have discussed about the existing techniques & their advantages, disadvantages. I have also discussed about the related paper in which existing methods Ire discussed.

In the 3rd section we have discussed about our proposed model. Why have I chosen these two types of techniques & what are the benefits of these techniques.

In the 4th section we have discussed about our implemented software which is a Black box testing oriented mean we don't need to know the internal structure or source code to check the vulnerability of a particular software. Not only this we have also discussed how these software works & what can be the output after using fault injector & property based injector. This part of this project plays a very important role as a practical example.

In the 5th section we have discussed about the advantages & disadvantages of these two techniques.

In the 6th section I have shown a basic comparison of these two techniques which one of our aims of this project.

At last we gave a summary that what we have done in this project & what is our future work.

Actually in this paper our aim is to show the over-view of two different types of software security testing techniques- Fault Injection, Property Based Injection. For a clear understanding about these two testing techniques, I have shown two type of software based on these two techniques. Finally I have shown a comparison between these two techniques.

II. Background and Feasibility Study

Penetration analysis, formal verification of security kernels [5, 6], model based testing, fuzzy testing, white box testing, risk based testing are used as traditional techniques to detect security vulnerabilities-

2.1 Penetration Analysis

Penetration testing is a type of analysis. This analysis is done on known security flaws in software systems. A team is being assigned the responsibility of penetrating the system. The disadvantage of penetration analysis is that it requires one either to know or be able to show the nature of flaws that might exist in a system. In contrary, penetration analysis is considered to be as good as that of the team that performs the analysis. A lack of an objective criterion to measure the adequacy of penetration analysis leads to uncertainty in the reliability of the software system. For this reason, penetration analysis did not reveal any security vulnerabilities.

2.2 Formal Security Testing

To implement the formal security testing, mathematical description of the security requirements of that system are used. The aim of this technique is to show formally that the requirements are indeed met by the system. Inherent difficulty is a major challenge for formal methods to suffer from specifying the requirements, the system, and then applying the process of checking the requirements specification against system specification. Recently, various specific security testing techniques have been developed [7, 8, 9, 10].

2.3 Model Based Security Testing

To implement the model-based testing technique, a model is needed to construct with the exact behavior and structure of the tested software. After construction, test cases are derived from the test model. Then the software is driven to run the test cases [29]. We can demonstrate the software system's behavior by input and output sequence, activity diagram, sequence diagram,

collaboration diagram, condition or data stream. FSM, UML model, Markov chain are commonly used as Software testing models.

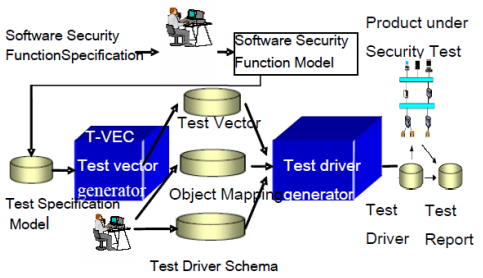

Figure 1: Process flow of Model based testing

2.4 Fuzzy Testing

To discover security vulnerability, fuzzy testing is effective and most popular technique. In this testing technique, random data are injected into program to test whether it can run normally under the clutter input. The efficiency of this technique is "it finds vulnerabilities of tested software, which is difficult for the other logical testing method". In contrary, this technique creates clutter data that's why sometimes this is considered as illogical.

2.5 White Box Testing

In this testing technique, the tester chooses inputs to exercise the paths through the code and determines the appropriate outputs. The goal of this testing is to ensure that all statements and conditions of the tested program have been executed at least once. So here, the application code should be visible and the tester should know the code [11]. This testing is a kind of correctness testing.

2.6 Risk Based Testing

Risk analysis is focused on risk based testing. The combination of security testing and software development lifecycle is used here to find high-risk security vulnerabilities. Though this technique the flaws or risks are found out as early as possible.

There are several security testing techniques which are used as general testing techniques, such as path testing, data-flow testing, domain testing, and syntax testing [12]. However, these techniques are still weak in discovering the security flaws. More studies are needed to justify their use in testing for security flaws.

Our aim is to discuss about Fault injection based testing & Property based injection testing. We have chosen these two type of techniques because in fault injection, experiments run in linear time & can be explored for new classes of faults. In property based technique all system abstraction levels are supported & not intrusive. There are many existing papers based on fault injection & property based but they have used the white box testing. In this paper we have shown ad addition of using the black box testing with fault injection technique & property based technique. And this addition made our work unique.

III. PROPOSED MODEL

We will discuss about Fault injection based testing and Property based testing techniques. Our proposed model is unique than the existing proposed papers because we have shown the basic fundamental of each technique and have also shown examples which is very helpful to clear our understanding about the topic. Not only this we have also implemented two types of software - one for fault injection & the other for property based testing techniques. In the existing paper they have used a white box testing which means a tester must know the source code & internal structure to perform the testing. But our empirical implemented software doesn't need to know the internal structure or source code of the particular system under test (SUT) which means our software is using the black box testing method.

3.1 Fault Injection Based Testing

In fault injection technique, fault models are required [13]. The model should be selected. The model selection depends on the nature of faults. Software errors arising from hardware faults, for instance, are often

modeled via bits of zeroes and ones written into a data structure or a portion of the memory [14,15], while protocol implementation errors arising from communication are often modeled via message dropping, duplication, reordering, delaying etc. [21]. Understanding the nature of security faults provides a basis for the application of fault injection. There are various related studies have been concerned of security faults [16, 17, 18, 19, 20]. Fault injection is a technique through which the dependability of a system under test can be assessed. It involves injecting faults into a system and monitoring the behavior of the system in response to a fault. Various fault injection methods have been proposed and practically experimented till now. We can group it into five sections. Those are- hardware-based fault injection, software-based fault injection, simulation-based fault injection, emulation-based fault injection and hybrid fault injection. For this study, I have focused on SWIFI techniques. It is worth noting, however, that both hardware-implemented and Simulator-based fault injection has long been used for testing, particularly of hard real-time and mission-critical systems. Fault Injection can be done in 2 different ways- Indirect fault injection, Direct fault Injection.

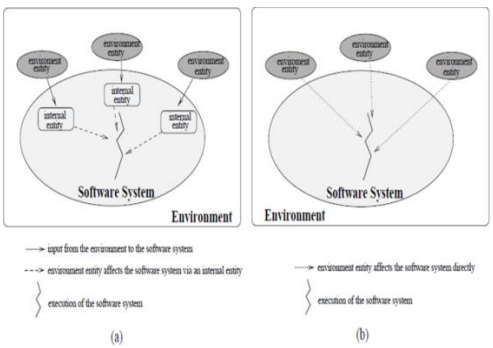

Figure 2: Interaction Model

Environment-Application Interaction (EAI) fault model which serves as the base of the fault injection technique. The advantage of the EAI model is in its capability of emulating environment faults that are likely to cause security violations.

Another issue in fault injection technique is the location, within the system under test, where faults are to be injected.

Environment faults affect an application in 2 different ways. The diagram (Fig. 2 (a)) shows that the environment indirectly causes a security violation that means environment faults affect an application through the internal entity. Suppose an application accepts its input from the network. Any fault in the network message related to this input is inherited by an internal entity. The application copies a memory from this message to an internal buffer. The application doesn't check the buffer's boundaries. The application fault in the network message & the fault being "message too long"! This situation creates a violation of security policy.

Figure 2(b) shows the direct way in which the environment faults affect an application. Let us consider an example to illustrate this second kind of interaction. Suppose an application needs to execute a file. There are two possibilities one being that the file belongs to the user who runs the application. Here the environment attribute is the proprietor of the file. In this case the execution is safe. The other possibility is that the file belongs to some malicious user. This is an environment fault created by the malicious user. Now the individual who runs the application assumes that the file belongs to the application. If the application does not deal with this environment fault, it might execute arbitrary commands in that file thereby resulting in a security violation.

3.1.1 Indirect fault injection

An indirect environment fault occurs at the interaction point. An application requests its environment for an input. The input that the environment provides to the application will most likely affect the behavior of application. A secure application should tolerate an unexpected problem in the environment input. There is one way to perturb the input. That is to use random input as in Fuzz [22, 23]. However, this

method dramatically increases the testing space.

3.1.2 Direct fault injection

A direct environment fault occurs at the interaction point where the application accesses an environment entity for creation, modification, reading or execution of an environment entity. Those interactions will be affected by different status of environment entity attributes. That's why, the environment fault injections are used to perturb the attributes of an environment entity. It places at points of interaction. It observes how the application responds to the perturbation.

3.2 Property Based Testing

Property-based testing (PBT) is a random testing technique in which the behavior of the system is exposed by an explanation of valid inputs to the SUT. In this technique, the expected properties are hold when the system is subjected to instances of valid inputs. A property based testing tool takes these definitions and successively generates inputs with increasing complexity. The tool then subjects the SUT to these inputs. Then it checks if the outputs falsify the properties or not. Following this method, the manual tasks of a tester are reduced to correctly specifying the parameters of the SUT and formulating a set of properties that accurately describe its intended behavior. PBT tools operate on properties, which are essentially partial specifications of the SUT, meaning that they are more compact and easier to write and understand than full system specifications. Users can make full use of the host language when writing properties. In this way, they can accurately describe a wide variety of input-output relations. They may also write their own test data generators. Compared to testing systems with manually-written test cases, "testing with properties" is a time consuming process. The resulting properties are also much more concise than a long series of unit tests, but, if used properly, can accomplish more thorough testing of the SUT by subjecting it to a much greater variety of inputs than any human tester would be willing or able to write.

Paper [24] describes a method of property -based testing. The method expresses security property of software into specification described by TASPEC language. It would extract the code by program slicing technology, and discover violation of the code against security property specification. Property-based testing focuses on some specific security properties. This property could meet requirement of classification and priority.

IV. IMPLEMENTED SOFTWARE FOR TESTING SOFTWARE VULNERABILITY

In this project I have implemented two applications (code injectors) for the purpose of testing vulnerability of software. In the previous papers they have shown the white box testing but I have exposed the black box testing here so I don't need to know the source code of the SUT application. One more thing, such types of software are not available in the internet to test the vulnerability of an application. The implemented software is simple. I have created some Sample applications for the sake of our project. Then I used that software (code injector) for verifying the vulnerability which clearly stands out as the most realistic & practical example.

4.1 Fault Injector

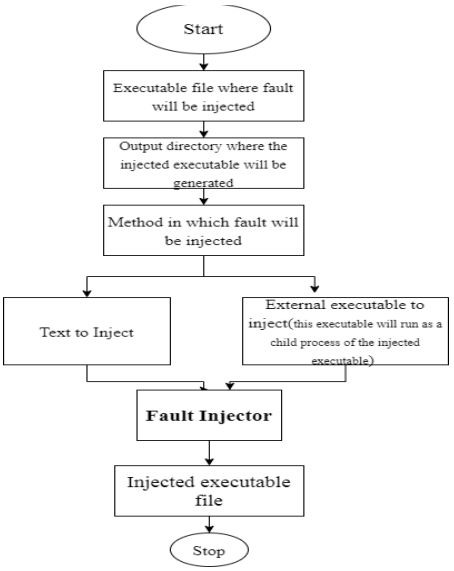

Figure 3: Flowchart of Fault Injector

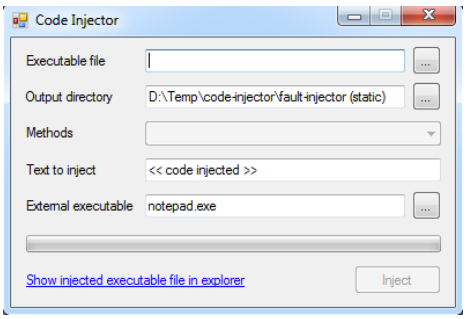

Figure 4: Fault Code Injector.

In this Sample application (written in C# programming language) I represented a multiplication operation using addition operator (Fig. 5).

```
using System;

namespace Dummy.Application
{
    public static class Program
    {
        private static int firstNumber = 20, secondNumber = 9;

        public static void Main(string[] args)
        {
            Console.WriteLine(firstNumber + " x " + secondNumber + " = "
                + MultiplyByAddition(firstNumber, secondNumber));
            Console.WriteLine("press any key to exit...");
            Console.ReadKey();
        }

        private static void SwapByXOR(ref int firstNumber, ref int secondNumber)
        {
            firstNumber ^= secondNumber;
            secondNumber = firstNumber ^ secondNumber;
            firstNumber ^= secondNumber;
        }

        private static int MultiplyByAddition(int firstNumber, int secondNumber)
        {
            int result = 0;

            if (firstNumber > secondNumber)
            {
                SwapByXOR(ref firstNumber, ref secondNumber);
            }

            for (int i = 0; i < firstNumber; i++)
            {
                result += secondNumber;
            }

            return result;
        }
    }
}
```

Figure 5: Sample application code.

The output of the above program (Fig. 6):

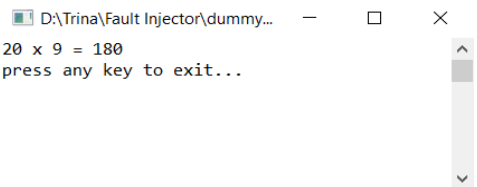

Figure 6: Output without using code injector.

The output of Sample program using Code Injector (Fig. 7)

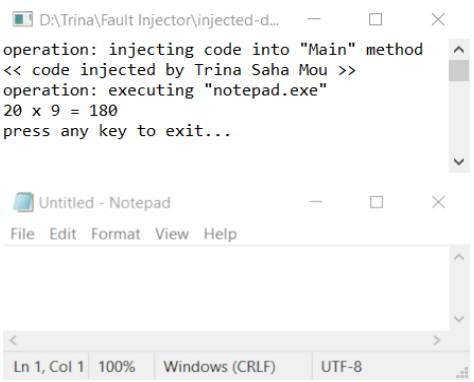

Figure 7: Output using Fault code injector.

Our fault injector (Fig. 4) works with executable files written in C#. It can inject custom text which will be printed in the console during execution of that program and at the same time it can also inject another program into the C# executable, which will be executed as a child process during the execution of the program. When user selects an executable file as input, our fault injector automatically retrieves all the method names from that executable file. So, source code of that program (C# executable) is not required. User can select a method from the list in which he/she can inject the desired text/external executable.

e.g. The Sample application prints the multiplied value of 20 and 9, which is 180 (Fig. 6). Now, this program has three methods named Main, SwapByXOR, MultiplyByAddition (I can see in the source code in Fig. 6). I wanted to inject the text "<< code injected by Trina Saha Mou >>" in the Main method. So, we selected the Sample application in the Fault Injector and it loaded all the methods. Then we selected main method from the dropdown menu of the Fault Injector and written the desired text and selected Notepad as the External executable and clicked Inject button. It generated the injected executable. After running the new executable file, we got the output shown in Fig. 7.

4.2 Property Based Injector

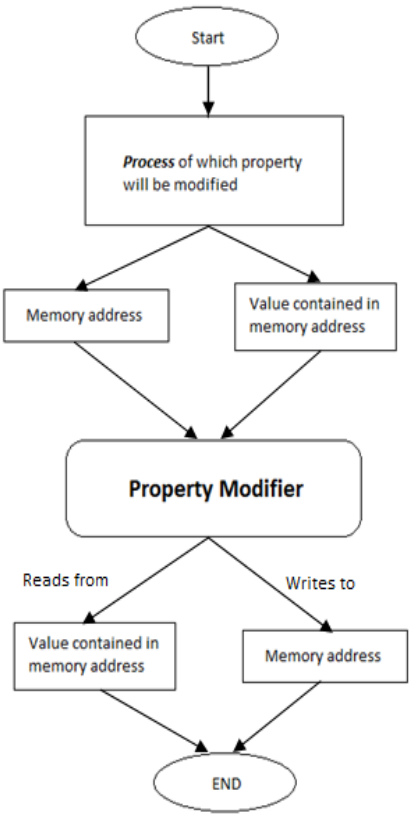

Figure 8: Flowchart of code injector (Property Modifier)

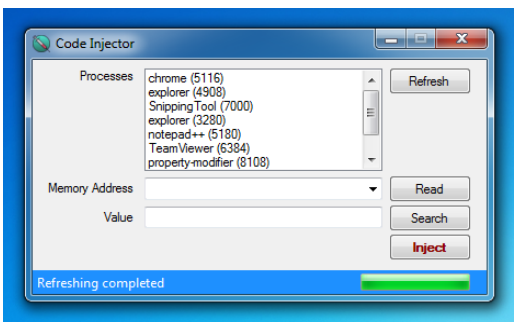

Figure 9: Property Code Injector.

In this Sample application (written in C programming language) I represented a multiplication operation using addition operator (Fig. 10).

```c
#include <stdio.h>
#include <time.h>

#define TRUE 1

static int value = 775, desiredValue = 809;

void sleep(long delay)
{
    if (delay <= 0)
    {
        return;
    }

    clock_t startingTime = clock();

    while (clock() < startingTime + delay)
    {
        // keep waiting...
    }
}

int main()
{
    while (TRUE)
    {
        if (value == desiredValue)
        {
            printf("status: value { %d } is equal to desired value { %d }\n", value, desiredValue);
        }
        else if (value < desiredValue)
        {
            printf("status: value { %d } is less than desired value { %d }\n", value, desiredValue);
        }
        else
        {
            printf("status: value { %d } is greater than desired value { %d }\n", value, desiredValue);
        }

        sleep(200);
    }

    return 0;
}
```

Figure 10: Sample application code.

The output of the above program (Fig. 11):

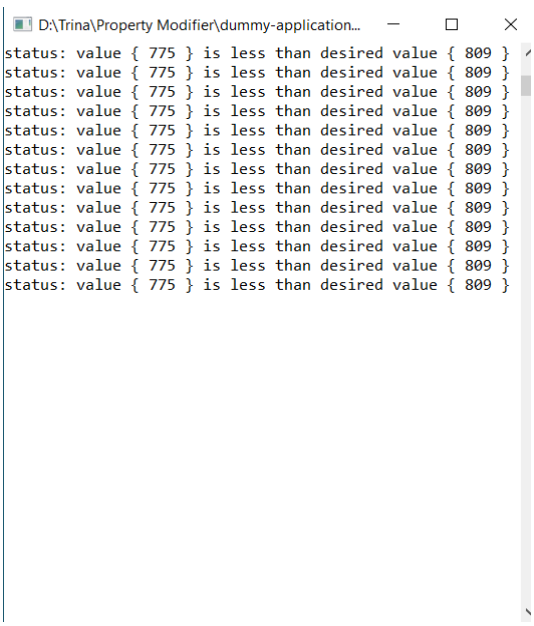

Figure 11: Output without using code injector (for property modifier).

The output of Sample program using Code Injector (Fig. 12)

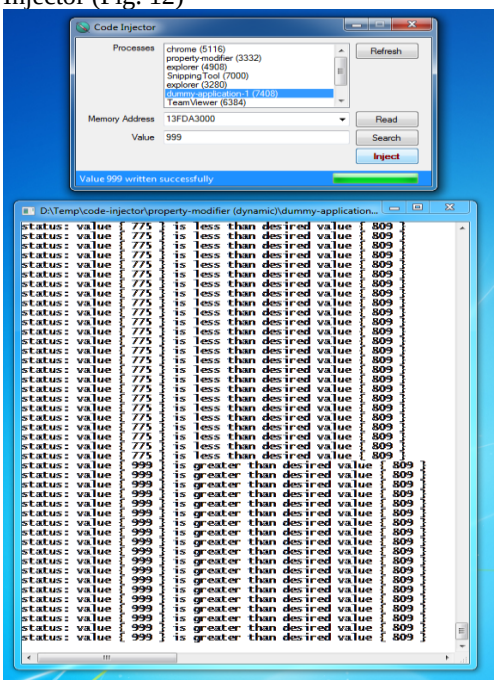

Figure 12: Output using Property code injector.

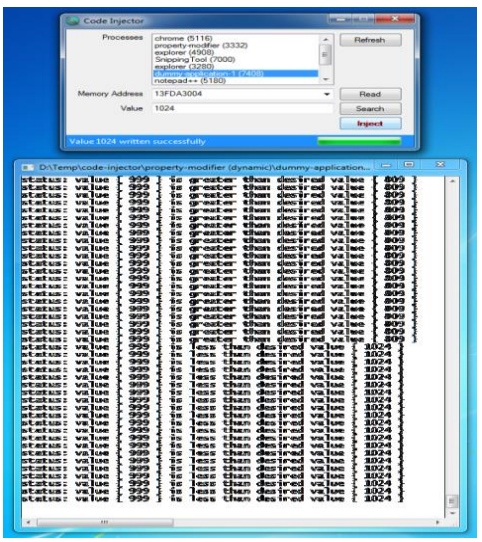

Figure 13: Another example output using code injector (property modifier).

Our property modifier can automatically retrieve all the processes running in an OS. A user needs to select a process and search for a value by placing a value in the specified field and clicking the Search button. Our code injector (property modifier) will then go to the address where the selected process is located in the memory and starts scanning the entire memory address space allocated for that particular process (including all the address spaces allocated for the threads of that process) by the OS. Whenever an address is found to contain the expected value, that memory address (hexadecimal) is added to the list (labeled as Memory Addresses). When user selects a memory address, places a value in the Value field and clicks the Inject button, the value is written to that address and if that address is associated with a variable, that change is reflected in that program's (process) execution path.

The Sample application is running continuously (Fig. 11). Initially I did not modify any of the two properties (value and desired value) of the Sample application. Then tried to change the value 775 to 999 (Fig. 12). So, we searched for value 775 in Sample application using Code Injector (property modifier) and found the memory address 13FDA3000. Then we injected value 999 and checked that the status of the Sample application is changed. We also changed that property desired value 809 in the same way and found that status is again changed (Fig. 13). So we can see that, the program's (Sample application) execution path is being changed externally by our Code Injector (property modifier). No source code or executable file is required for this approach.

V. ADVANTAGE & DISADVANTAGE OF FAULT INJECTION & PROPERTY BASED TECHNIQUE

5.1 Fault Injection Based testing

Advantage:

1. Target users of this technique are those applications and operating systems, which are facing difficulty in using hardware fault injection.

2. Experiments run in near real-time, allow the running of a large number of fault injection experiments.

3. The fault injection experiments are running on the real hardware. The advantage of this technique is including any design faults that might be present in the actual hardware and software design.

4. Does not have any require of special-purpose hardware; complexity is low, development and implementation cost is very low.

5. Model development is not required. Same as validation.

6. We can also expand the existing one for new classes of faults.

Disadvantage:

1. Injection instants are limited: which are only for assembly instruction level.
2. Faults cannot be injected into locations because that are inaccessible to software.
3. To support the fault injection source code modification is needed. This means that the executing code in the fault experiment is not the same code that will run in the field.
4. Observation and control ability is limited. At best, one would be able to corrupt the internal processor registers (as Ill as locations within the memory map) that are visible to the programmer, traditionally referred to as the programmer's model of the

processor. So faults cannot be injected in the processor pipeline or instruction queue for example.
5. Permanent faults are very difficult to model.

6. Related to four, execution of the fault injection software could affect the scheduling of the system tasks in such a way as to cause hard, real-time deadlines to be missed, which violates assumption two.

5.2 Property Based Testing

Advantage:

1. This technique is designed to support all system abstraction levels.

2. Not intrusive.

3. Full control of both property models and injection mechanisms.
4. Low cost computer automation; does not require any special-purpose hardware.
5. Observation and controllability is high.
6. Performs reliability assessment at different stages in the design process.
7. Transient and permanent faults are modeled here.

Disadvantage:

1. Development effort is high.
2. Time consuming.
3. Models are not readily available; rely on property accuracy
4. The result's accuracy depends on how good the model is used.
5. Real time property based injection is not possible in a prototype.
6. Property may not include any of the design faults that may be present in the real hardware.

VI. BASIC COMPARISON BETWEEN FAULT INJECTION & PROPERTY BASED TECHNIQUE

	Fault Injection	**Property based injection**
1	Can Inject any malicious code or content.	Can inject any variable to modify the property.
2	It must change the execution path of a program.	It may/may not change the execution path of a program.
3	No model development or validation Required.	There exists model Development or validation.
4	Can verify any software through injecting another software.	No possibilities of injecting through software.
5	Limited set of Injection Instants.	Unlimited set of Injection Instants.
6	Time consuming	Takes much time than Fault Injection.
7	Injecting Fault in executable written high level language like Java, C# is easier than low level language like C, C++.	Difficulty level remains same regardless of the level of language.

Table 1: Comparison of FAULT INJECTION & PROPERTY BASED INJECTION

VII. CONCLUSION

The goal of technology enhancement is to serve humanity by ensuring the security. Now-a days the whole world especially the industries are increasingly more dependent on technology. This phenomenon has increased more security risks and security threats for the consumers [26, 27, 28]. So we have to be more concerned in developing protected software. In this paper, we have discussed two most popular software security testing methods which are Black box oriented. Fault injection technique involves injecting faults into a system and monitoring the behavior of the system in response to the fault. This method is an effective way to assess the presence of hidden bugs. Using the Property based testing; one can change the value of the variables and can verify security level of an application which means one can change the execution path by changing the property of that application without knowing the source code of that application. We have also shown two different types of software (Code Injector) which were implemented by me for the sake of our project. One of our aims was to represent that how an application could be verified as secured using these code injectors. And we successfully represent it as an application. At last we have also shown a basic comparison between these two types of testing techniques. So finally I can say that our project is successfully done & below I have given our implemented software link so anyone can visit it. As a future work, we would like to make these tools more automated and also want to improve the performance.

Here is implemented software link:

https://drive.google.com/drive/folders/1zaVCciQUlbQSymSdD6_vNjxDBWsyl-gR?fbclid=IwAR3RdfLUgR9LJ3txxbAaqkMTi5l5oWzQlH-Wmk9p-B3u4ex9tKlDXW08JZQ

REFERENCES

[1] IEEE Std. 1633-2008 IEEE Recommended Practice on Software Reliability, pp. c1–72, June 2008.

[2] Gary McGraw, Bruce Potter. “Software Security Testing”[J]. IEEE Security & Privacy, 2004, 2(5):81-85.

[3] Du Inliang , Mathur A P. “Vulnerability Testing of Software System Using Fault Injection”[R]. Coast TR 98-02, 1998.

[4] Du Inliang, Aditya P. Mathur. “Testing for Software Vulnerability Using Environment Perturbation”[C]. In proc. DSN 2000.pp.603-612.

[5] R. R. Linde. Operating system penetration. In AFIPS National Computer Conference, pages pp. 361–368, 1975.

[6] E. J. McCauley and P. J. Drongowski. The design of a secure operating system. In National Computer Conference,1979.

[7] M. Bishop and M. Dilger. Checking for race conditions in file accesses. The USENIX Association Computing Systems, 9(2):131–151, Spring 1996.

[8] G. Fink and K. Levitt. Property-based testing of privileged programs. In Proceedings of the 10th Annual Computer Security Applications Conference; Orlando, FL, USA; 1994 Dec 5-9, 1994.

[9] V. D. Gligor, C. S. Chandersekaran, W. Jiang, A. Johri, G. L. Luchenbaugh and L. E. Reich. A new security testing method and its application to the secure xenix kernel. IEEE Transactions on Software Engineering, SE-13(2):169–183, February 1987.

[10] B. Miller, D. Koski, C. Lee, V. Maganty, R. Murthy, A. Natarajan and J. Steidl. Fuzz revisited: A re-examination of the reliability of unix utilities and services. Technical report, Computer Sciences Department, University of Wisconsin, 1995.

[11] Xia Yi-min, etc. “Security Vulnerability Detection Study Based on Static Analysis”. Computer Science, 2006.33(10).

[12] B. Beizer. Software Testing Techniques. Van Nostrand Reinhold, New York, 1990.

[13] J. Clark and D. Pradhan. Fault injection: A method for validating computer-system dependability. IEEE Computer, pages 47–56, June 1995.

[14] G. Kanawati, N. Kanawati and J. Abraham. FERRARI: A tool for the validation of system dependability properties. In Proceedings 22nd International Symposium Fault Tolerant Computing, pages 336–344, July 1992.

[15] S. Han, K. Shin and H. Rosenberg. Doctor: An integrated software fault injection environment for distributed real-time systems. Technical report, University of Michigan, Department of Elect. Engr. and Computer Science, 1995.

[16] T. Aslam. A taxonomy of security faults in the unix operation system. Master's thesis, PurdueUniversity, August 1995.

[17] M. Bishop. A taxonomy of unix system and network vulnerabilities. Technical Report CSE-95-10, Department

of Computer Science, University of California at Davis, May 1995.

[18] W. Du and A. Mathur. Categorization of software errors that led to security breaches. Technical Report COAST Technical Report 97-09, Purdue University, Department of Computer Sciences, 1997.

[19] I. Krsul. Computer vulnerability analysis thesis proposal. Technical Report CSD-TR-97-026, Computer Science Department, Purdue University, 1997.

[20] C. E. LandIhr, A. R. Bull, J. P. McDermott and W. S. Choi. A taxonomy of computer program security flaws. ACM Computing Surveys, 26(3), September 1994.

[21] S. Dawson, F. Jahanian and T. Mitton. ORCHESTRA: A fault injection environment for distributed systems. In 26th International Symposium on Fault-Tolerant Computing (FTCS), pages 404–414, Sendai, Japan.

[22] JunB. Miller, L. Fredriksen and B. So. An empirical study of the reliability of unix utilities. Communications of the ACM, 33(12):32–44, December 1990.

[23] B. Miller, D. Koski, C. Lee, V. Maganty, R. Murthy, A. Natarajan and J. Steidl. Fuzz revisited: A re-examination of the reliability of unix utilities and services. Technical report, Computer Sciences Department, University of Wisconsin, 1995.15

[24] George Fink, Matt Bishop. "Property Based Testing: A New Approach to Testing for Assurance"[J]. ACM SIGSOFT Software Engineering Notes, 1997, 22(4):74～80.

[25] Manolis Papadakis and Konstantinos Sagonas. 2011. A PropEr Integration of Types and Function Specifications with Property-based Testing. In Proceedings of the 10th ACM SIGPLAN Workshop on Erlang. ACM, New York, NY, USA, 39–50. https://doi.org/10.1145/2034654.2034663

[26] G. McGraw, "Software Security", IEEE Security Privacy, vol. 2, (2004), pp. 80-83.

[27] Definition of Accountability, Available at: http://en.wikipedia.org/wiki/Accountability last visit Oct 03 (2014).

[28] S. A. Khan and R. A. Khan, "Securing Object Oriented Design: A Complexity Perspective", International Journal of Computer Applications, vol. 8, no.13, October (2010).

[29]Yan Jiong, etc. "Survey of Model-Based Software Testing" Computer Science, 2004.31(2)

[30] Brad Arkin, Scott Stender, Gary McGraw: "Software Penetration Testing"[J]. IEEE Security & Privacy , 2005, 3(1): 84-87.

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Design and Implementation of Transformer Protection Scheme Based on Micro PLC

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Abstract—An electrical power system consists of various components such as generators, switches, transmission cables, transformers, capacitor banks among other components. Within these, a transformer is a very valuable and needy device in a power transmission and distribution system and it needs to be protected from the fault that occurred in the power system. A protection scheme is presented in this paper, which can be used in transformer protection. The main intention of this proposed system is to design a micro-PLC-based system that checks the operating parameters of the transformer i.e., voltage, temperature, oil pressure and the quantity of current that is flowing through the transformer. The system is able to detect current above the normal operating level and isolate the power transformer from the distribution line. This isolation process is to ensure that the transformer is protected from any abundance current that can cause it to overheat consequently to be harmed. In addition, the designed system can isolate the transformer if the voltage, temperature, and pressure are higher than its normal operating value. Some of the tools used in this protection system include LDmicro- programming software to write the ladder logic diagram for the microcontroller. Proteus-simulation software has also been used to design the circuit diagram and the Printed Circuit Board (PCB) for its implementation on hardware.

***Keywords*—Transformer protection, Micro PLC, Faults, LDmicro ladder logic**

Introduction

In the modern age, PLC automation has been assumed as a significant function in power reliability and economy. A transformer is a very expensive and important device in a power transmission and distribution system. Faults in the power system may include short circuits, over-current, over-voltage, high temperatures among others. Primarily transformers are protected from fault conditions but for stability, reliability, and security of the system, a better protection scheme is required [1]. Higher current drawn from the power line due to the overload or short circuit can lead to a transformer being damaged. High reliability of the transformer is required to avoid disturbances due to faults in the transmission of power. There are two types of faults classified in the transformer: external faults and internal faults. The internal incipient faults usually develop very slowly in the form of a gradual deterioration of the insulation due to some causes [2]. This is essential to protect the high values of variables in the transformer against external and internal electrical faults. To protect and smooth the operation of the transformer, PLC automation is used.

The various types of fault in the transformer can be detected and rectified by using a PLC system due to the wide range of PLC automation. Many protective schemes were

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proposed to protect the transformer from abnormal conditions. Rohan Perera et al. [3] presented an application of the protection system of the in-line where a transmission line of the power system terminates on a transformer and a single protection zone includes both the line as well as the transformer. An AVR microcontroller-based system has been developed in [4] that is used for logging the voltage, current, and temperature of a
power transformer and protects it from any uncertain conditions. Anurudh Kumar et al. [5] proposed a GSM-based fully automated system in the power transformer.

In this planned protection system, a small PLC consists of a PIC16F877A microcontroller has been accustomed to distribution transformer protection theme with low maintenance. Also, there is no need for expert personnel to program PIC microcontrollers because it is very easy to program using LDmicro software. The purpose of this work is to design and implement a micro-PLC-based system that will intelligently detect faults and protect the transformer by separating it from the main power line.

I. TRANSFORMER FAULT DETECTION

A. Over Voltage Fault

Over voltage fault occurs when the operating voltage exceeds the predetermined limit of the rated voltage. Also, this situation can happen in the transformer terminal due to the sudden disconnection of large loads. The magnitude of this voltage is higher than its normal value. Ali Kazemi et al. [6] present over-excitation protection through a Volts/Hz element that calculates the ratio of the measured voltage to the frequency in p.u. of the nominal quantities [7]. Overvoltage faults can detect by a potential transformer and potentiometer. This type of fault causes an increase in stress on the insulation of the transformer.

B. Over Current Fault/Overload Fault

Overloading the secondary side of the transformer leads to an excessive quantity of current flowing into the transformer. Over current fault occurs if the current exceeds the value of the rated current. Due to this fault, the temperature of the transformer increases which in turn decreases the insulation life span and transformer winding. This fault can detect by the current sensor and current transducer.

C. Over Temperature Fault

The IEEE standard ambient temperature rating based on 24 hours is 30℃ (86℉) [8]. Overvoltage and the over current increase the temperature of the transformer oil, which causes the failure of the insulation of the transformer winding. When the temperature of the transformer increases to the upper limit of temperature rating, the over-temperature fault will occur. The temperature sensor is used to detect an over-temperature fault.

D. Phase-to-Phase Fault

When anyone line is directly short to the opposite within the transformer is named phase to phase fault. If the fault occurs, it will lead rise to a substantial current compare to the earth fault currents. This type of fault increases substantial current to operate the instantaneous over current relay on the primary side as well as the differential relay. When the phase-to-phase fault occurs in the transformer, the relay isolates the circuit automatically.

II. PROPOSED SYSTEM

In this proposed system, a micro-PLC-based protection system is proposed, which will automatically detect faults and prompt a protection system to protect the transformer. In the following section, the block diagram, the development of the circuit diagram, and the PCB design of the Micro-PLC have shown in detail.

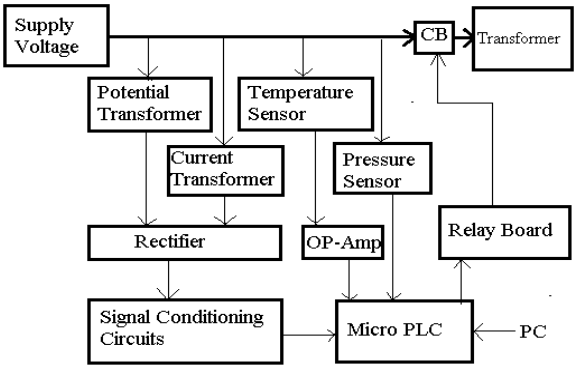

Fig. 1. Functional block diagram of the proposed system.

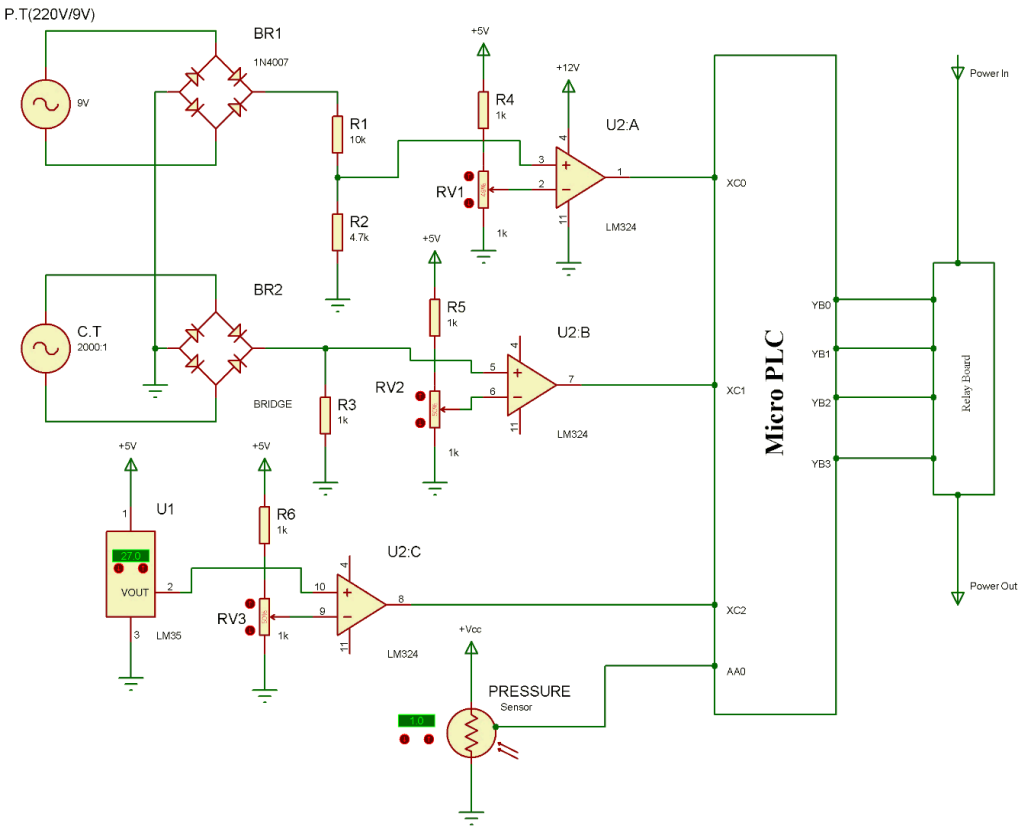

Fig. 2. Overall circuit diagram of the proposed system. Micro PLC consists of a PIC microcontroller and other input/output circuits.

A. Block Diagram

The functional block diagram of this proposed system has shown in Fig. 1. A micro-PLC that consists of a PIC16F877A microcontroller controls all the operations that the device does.
The relay board has used as a switching gear, which operates a circuit breaker to separate the transformer from the power system in the event of a fault. Instrument transformers have been used to detect over current and overvoltage faults of the system.
Temperature and pressure sensors have been used to measure the temperature and pressure of the transformer oil. All these peripheral devices depend on the microcontroller to make them operate. If the current or voltage reaches above the normal operating level the power transformer gets isolate from the distribution line.

B. Circuit Diagram

The development of the circuit diagrams of this proposed system are shown in Fig. 2-7 gradually. In Fig. 2, the overall circuit diagram has shown where the micro-PLC is considered a block. From Fig. 3-7, the design of the internal circuit diagram of the micro-PLC block has been presented.

In Fig. 2, two instrumentation transformers have used in which one is the potential transformer (above), and another one is the current transformer (below), on the left side of the programmable logic controller (PLC).The Instrument transformers have been used to step down the magnitude of system voltage from 230V to 9V r.m.s. and load current 10A to 5mA r.m.s. of the single-phase 50Hz supply.

The output of the instrument transformer has fed into the bridge rectifier circuit: where the alternating signal converted into the pulsating unidirectional signal. In the power supply unit, which is shown in Fig. 6, three electrolyte capacitors have been used to filter pulsating DC voltage at the output terminals of the bridge rectifier and positive voltage regulator IC. Here the ripple of the pulsating DC is 80-90% removed. 104 pico-farad ceramic capacitors were used across the regulators to get smooth and noise-free output. It can bypass high-frequency noises.

In Fig.4, the Zener diode is connected in the reverse-biased mode across the PLC analog input terminal of AA0, which protects the signal conditioning circuit from the reverse current. In this proposed protection system, we have used an LM35DZ temperature sensor, an MP3V5050 pressure sensor, a TA1309-200 precision C.T, a
220V/9Vstep-down transformer as P.T, and LM324N op-amp as a comparator. Three potentiometers, RV1, RV2, and RV3, have been used to determine abnormal values of voltage, current, and temperature, respectively. When the input parameter value exceeds the abnormal value, the op-amp-output becomes high.

The U2.A, U2.B, and U2.C op-amp output has connected to the digital input pin XC0, XC1, and XC2, and the pressure sensor output has connected to the analog input pin AA0 of the micro-PLC, respectively.

The PLC compares the real-time data of all inputs with the pre-defined values that are set on the ladder and generates control signals depending on the programming conditions which are fed to the relay board. The relay circuit trips the breaker and separates the transformer from the live line to protect it from damage.

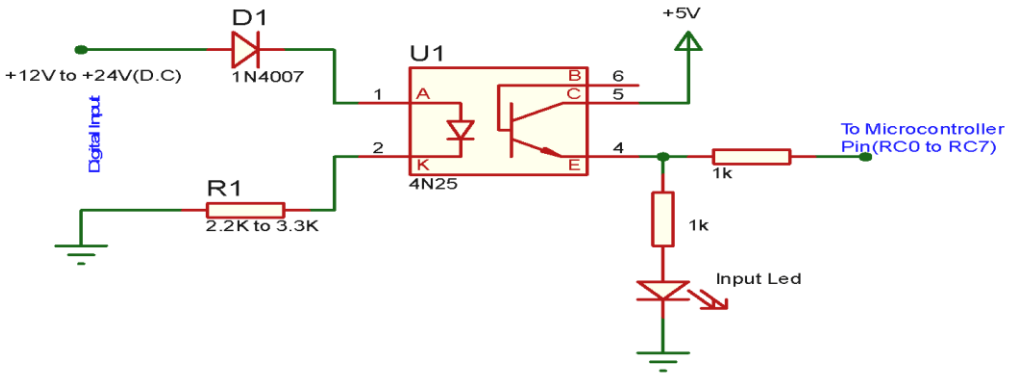

Fig.3. Designed circuit diagram for the digital input of Micro PLC.

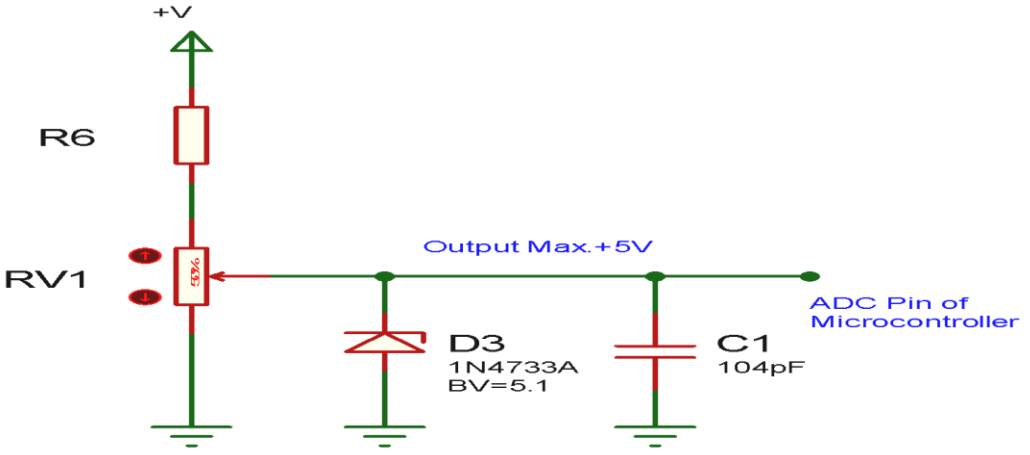

Fig.4. Designed circuit diagram for the analog input of Micro PLC.

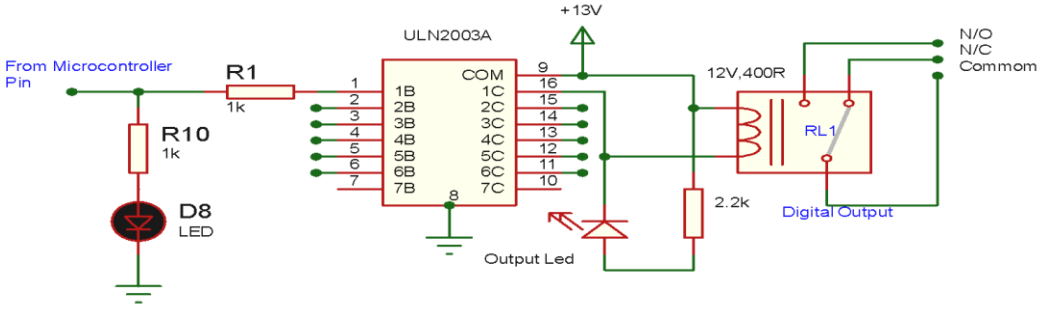

Fig.5. Designed circuit diagram for the digital output of Micro PLC

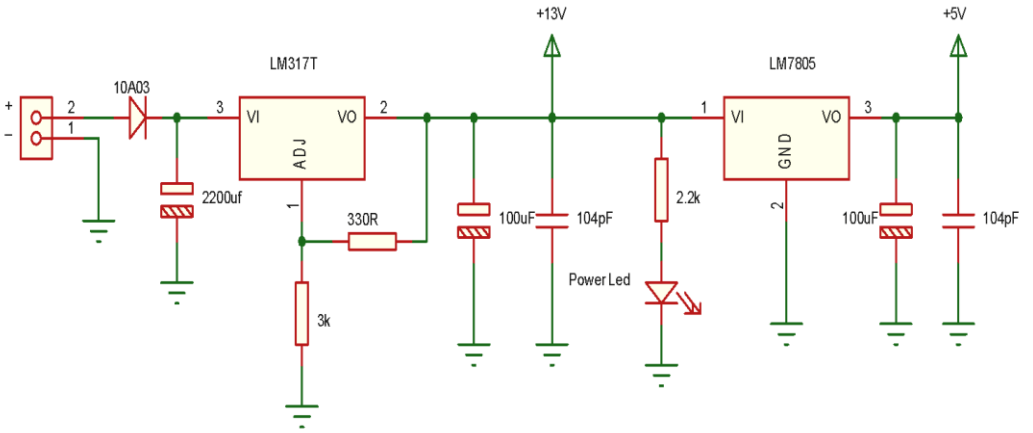

Fig. 6.Designed DC power supply unit of Micro PLC.

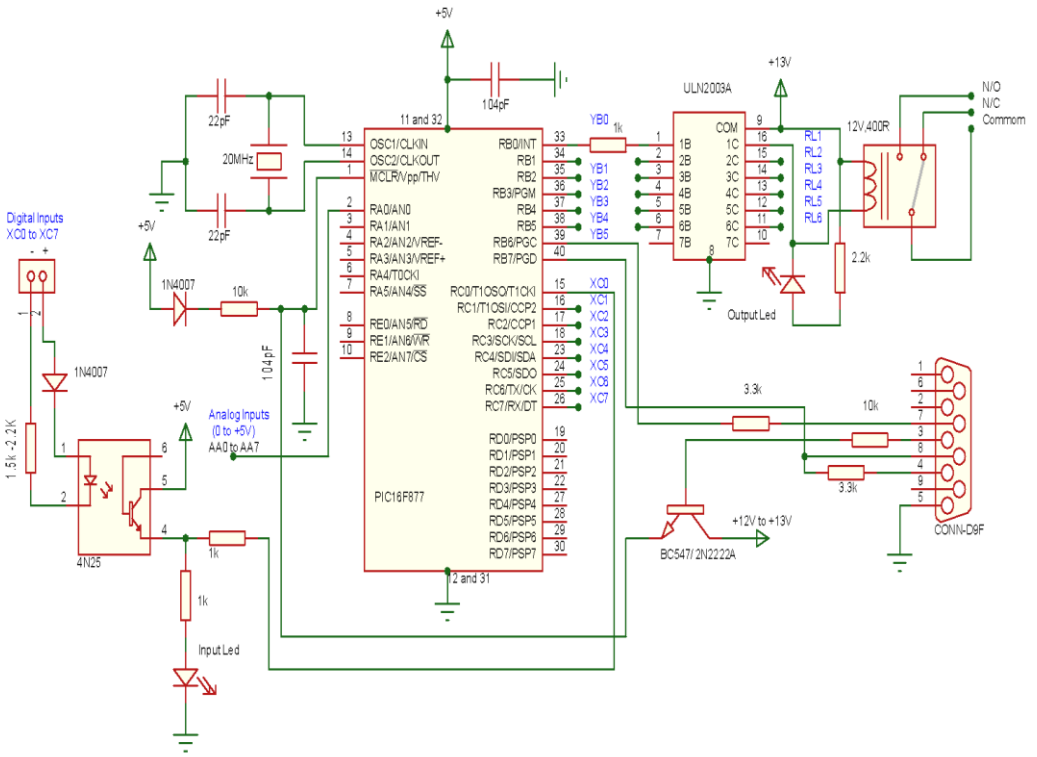

Fig.7. Complete designed circuit diagram of Micro PLC. Instrument transformers, temperature sensor, and pressure sensor are connected with this Micro PLC.

C. PCB Design:

Breadboards are for circuit implementation. However, in this proposed work, PCB has been used to prototyping circuits to make the system more robust and permanent. Proteus 7.10 software has been used to design the Micro-PLC Printed Circuit Board (PCB) layout. The designed 3D model and PCB layout are shown in Fig. 8-9.

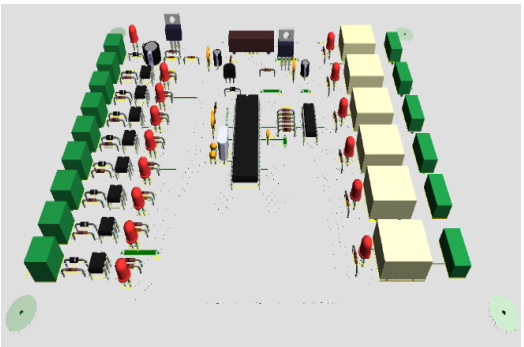

Fig. 8. 3D Visualization of Micro PLC.

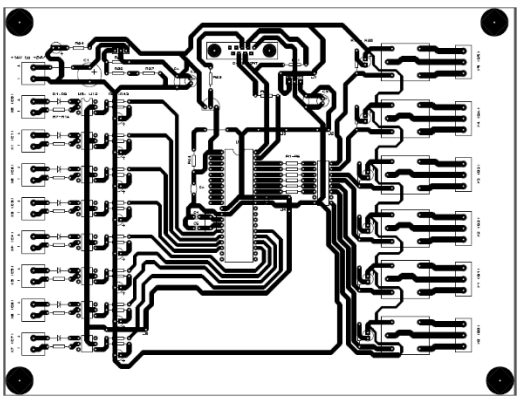

Fig. 9. PCB layout of Micro PLC.

D. Software Implementation

For programming, the LDmicro ladder logic (Version 2) software has been used. It generates native code for Microchip PIC16 and Atmel AVR series microcontrollers. LDmicro compiles ladder logic to HEX code. LDmicro ladder diagram and Micro-PLC pin configuration are given below.

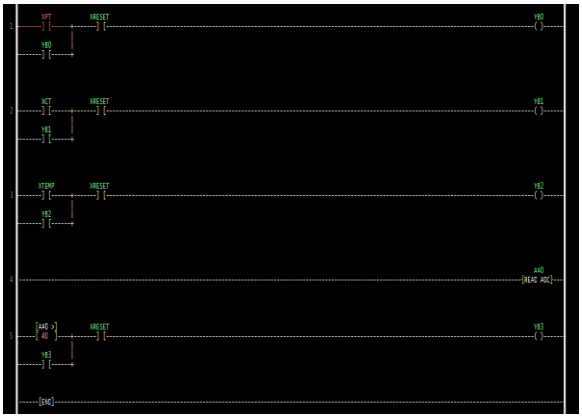

Fig. 10.LDmicro Ladder Logic Program.

Name	Type	State	Pin on Processor	MCU Port
XCT	digital in		16	RC1
XPT	digital in		15	RC0
XRESET	digital in		18	RC3
XTEMP	digital in		17	RC2
YB0	digital out		33	RB0
YB1	digital out		34	RB1
YB2	digital out		35	RB2
YB3	digital out		36	RB3
AA0	adc input		2	RA0

Fig. 11. Pin configuration of LDmicro PLC.

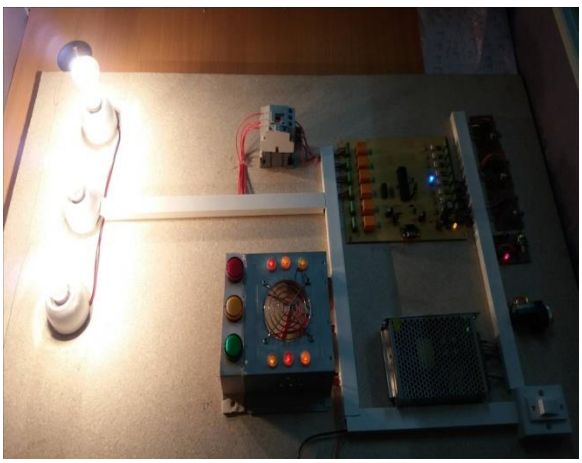

Fig.12.Implemented model of the proposed transformer protection system.

TABLE I. EXPERIMENTAL RESULTS

Input Parameters	Set Values (POT)	Real-Time Values	Relay Board Status	Main C.B
Voltage	2.40V	232V	YB0 Pin High HV Relay ON HV Indicator ON	Trip
	2.50V	241V		
	2.30V	223V		
Current	0.50V	1.10A	YB1 Pin High OL Relay ON OL Indicator ON	Trip
	1.10V	2.30A		
	1.32V	2.90A		
Temperature	0.30V	31°C	YB2 Pin High HT Relay ON HT Indicator ON	Trip
	0.43V	44°C		
	0.52V	52°C		
Pressure	20 Steps	1.81kPa	YB3 Pin High HP Relay ON HP Indicator ON	Trip
	40 Steps	3.61kPa		
	90 Steps	8.13kPa		

III. Results

In this proposed system, Micro PLC has appropriately worked. This system was able to detect faults like over-voltage, over-current, over-temperature, and high-pressure faults. After the detection of any fault, it accurately and successfully isolates the transformer from the power line. The implemented hardware of the proposed system and the experimental results are shown in Fig.12 and Table I respectively.

IV. Cost Analysis

The smallest and cheapest PLC in the current market is the Controllino Mini 100 - 000 -00 PLC. Its market price is US $ 149.00 [9]. But the construction cost of the proposed Micro PLC with the same feature is US $ 25.0. This is really cost-effective.

V. Conclusions

The proposed Micro PLC-based system has been designed to protect the transformer during faulty conditions, and it continuously monitors the parameters of the transformer throughout its operation. If the system detects an increase in the level of voltage, current, or temperature from its predetermined values, the system separates the transformer from the power line to prevent it from damages with the help of relays and circuit breaker. The proposed system is suitable for the protection of low voltage distribution transformers, industrial voltage level converters, and spot-welding machines.
It is designed to operate accurately in a wide temperature range, with very high electromagnetic noise, and high vibration conditions. It can also operate in dusty or humid environments. Thus, employing the proposed system has made the system more secure, reliable, and highly cost-efficient.

References

[1]. Sarfaraz Nawaz Syed, S. Radhika, M.N. Sandhya Rani, “Differential current protection of transformer using arduino with voice alert”, GRIET, Hyderabad, Andhra Pradesh, 2015 International Journal of Innovations in Engineering and Technology

[2]. Cristina Ciulavu & Elena Helerea, “Power Transformer Incipient Faults Monitoring”, Annals of the University of Craiova, Electrical Engineering series, No. 32, 2008; ISSN 1882-8805.

[3]. Rohan Perera & Bogdan Kasztenny, “Application Considerations When Protecting Lines With Tapped and In Line Transformers”, previously presented at 2014 Texas A&M Conference for Protective Relay Engineers, © 2014 IEEE – All rights reserved. 20140210, TP6575-01.

[4]. V. Thiyagarajan & T.G. Palanivel, “An Efficient Monitoring of Substations Using Microcontroller Based Monitoring System”, IJRRAS 4 (1), July 2010.

[5]. Anurudh Kumar, Ashish Raj, Abhishek Kumar, Sikandar Prasad & Balwant Kumar, “Method for Monitoring of Distribution Transformer, Undergraduate Academic Research Journal (UARJ)”, ISSN: 2278 – 1129, Volume-1, Issue-3, 4 - 2012.

[6]. Ali Kazemi & Casper Labuschagne ,“Protecting Power Transformers From Common Adverse Conditions”, paper presented at the Ga-Tech and the

Western Protective Relay Conferences, New Berlin" in 2005.

[7]. Vinay Barhate, "A Review Of Distinguishing Schemes For Power Transformer's Magnetizing Inrush And Fault Currents", IJEEER, ISSN 2250-155X, Vol. 3, Issue 2, Jun 2013, 277-288© TJPRC Pvt. Ltd.

[8]. N. A. Anshari Munir, Y.A. Mustafa and F. Siagian, "Analysis of The Effect of Ambient Temperature and Loading on Power Transformers Ageing (Study Case of 3rdPower Transformer in Cikupa Substation)" presented at the 2019 2nd International Conference on High Voltage Engineering and Power Systems (ICHVEPS), Denpasar, Bali, Indonesia, Indonesia, Oct.1-4, 2019.

[9]. https://www.amazon.com/100-000-00-Controllino-Industrial-arduino-Source/dp/B07WSXF7D1 Retrieved: 27th February, 2021

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Impact of Artificial Intelligence in front end Military operations

Sadia Islam[1]

***Abstract*—Artificial intelligence is a computer or software or any machine which has the ability to think intelligently. The major goals of AI are to create an expert system and to implement human intelligence in machines. AI is now an increasing demand in the field of military. It is already being used in different sectors of military and one of those is the military operation. Researchers and developers are nowadays working on this to analysis, invent algorithms and develop systems in order to conduct military operation easily and efficiently. This paper is about explaining the areas of military operation where AI is being used and also about those fields where researchers are doing research to adapt AI including the advantages and disadvantages of adopting these technologies in those fields and also the problems that are faced in order to adopt the artificially intelligent system. This paper also includes the research gaps in this area and a proposed solution to fill the gaps and make the best use of AI in military operation**.

***Keywords*—AI; operation; military; autonomous; weapons; machines; system; missiles**

1. Introduction

Artificial intelligence is a technology developed to make intelligent decision by analysing the environment around and base on stored data. The first formal application (Deductive reasoning) of artificial intelligence was invented in the 4th century [1]. Since then, artificial intelligence is being used in different sectors with success. Artificial intelligence (AI) is an intelligent machine or software system which simulates human intelligence. AI aims to improve the outcomes while complex tasks that are done by machines applying human intelligence. AI follows a sequence known as perception-cognition-action which generally followed by human analyzation [4]. AI is programmed to do something similar by sensing the world around with different types of sensors, processing the information with verification and optimization algorithms, with a choice of action it takes the decision. It has now become a major thing to automate any system. AI allows working a system intelligently without having any human interaction.

Today AI is being used very vastly in the field of military. AI methodologies are being applied to support decision-making, better communication, military training, helping them in warfare etc. The Department of Defence (DoD) is increasingly interested in AI [2]. Autonomous weapons, drones are already invented using machine learning to automate operations. Autonomous weapons can target enemies and take real-time decisions to kill those enemies. This drones can detect obstacles and take intelligent decisions at the real time. Artificially intelligent driverless cars are also invented and being used in military field during operations. In this modern era, artificial intelligence is a vast area to explore and take the advantages using this intelligence in military field to make the front end operations easier and safe. AI is also being

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used in predicting enemy actions. Real-time Adversarial Intelligence and Decision-making (RAID) program are investigating to read enemy mind in real time to estimate enemy's probable goals, action, description, position and movement [3].

Artificially intelligent machines and software that are being invented to use in military during wartime are helping to conduct a war safely using robots and technologies but at the same time it also contains security issue as an artificially intelligent machine can be damaged or disordered by system failure and can take a wrong decision or give the wrong prediction. To make a system artificially intelligent it is needed to train the system first with appropriate training data. Proper training with appropriate data is the main criteria to build an artificially intelligent system. Use of AI in military operations for example autonomous weapons, if the system is not been trained properly then it even can create a threat to human lives.

1 Literature Findings

Today artificial intelligence is a rising topic in the field of military. Researchers are inventing new ways and technologies using AI to make military operations easy and safe. Military robots are one of them. It is said that in future military and commercial robot will be capable to do tasks and conduct missions on their own with the use of 'artificial intelligence' (AI) [4].

A. Autonomous systems

Nowadays, machine learning has become a big part of artificial intelligence. Machine learning is a process of training a machine like this so that it can take the proper decision and do the specific work by itself in a changing environment. To make a system autonomous, it is needed to make a machine artificially intelligent first by applying machine learning algorithms. Autonomy of any system needs a proper training. It should be able to receive real-time data from a sensor all the time which keeps the system updated with the environment around. An autonomous system should be updated with the data of the world model and data from the sensors. After having this data it optimizes and by analyzing the data the system takes actions [4]. Here is a diagram in figure 1 which shows the process of taking data from environment, optimizing and taking action depending on the optimization result-

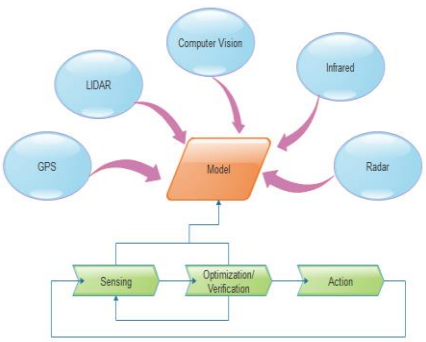

Figure 1. AI of an autonomous system [4].

- *Autonomous weapons:* The concept of automatic has been moved to autonomous now. Previously automatic systems was a great inventory of AI-based system. Now, the system has been changed to autonomous system from automatic system. The main difference between automatic and autonomous system is that automatic system can work automatically but there must be a human interaction behind the system and for autonomous systems, it takes a decision by itself without any human involvement. Autonomous weapons for military operation are an increasingly demanding

requirement of the battlefield. Many leading AI researchers signed a letter that was presented at the International Joint Conference on Artificial Intelligence in Argentina described autonomous weapons as the third revolution in warfare after gunpowder and nuclear arms [13]. A top British intelligence expert has claimed that by 2025 US military will have more robots soldiers on the battlefield than the human. Russia is also focusing on developing similar robots to match with the increasingly demanding factors. It is also said that the next generation should bring advanced capabilities to match up with the increasingly complex operational environments to maximize the overall performance. A security consultant who has a 20-year career at GCHQ said that deadly combat robots are rapidly becoming "a reality" of modern-day [12]. But there is a debate on the fact that whether any artificially intelligent machines should be allowed to perform military operations, especially when there is a possibility that any human life can be at a stake if any wrong decision is made [4]. When the decision of taking a human life is made by a machine, then the matter should be considered seriously.

Human Experts	Expert System	Conventional programs
Uses inexact reasoning. Incomplete, information can handle.	Inexact reasoning. Can deal with incomplete, information.	Exact reasoning. Complete data is needed
For incomplete information, can make give wrong answer.	For incomplete information, can make give wrong answer.	Provides no solution or wrong solution when data is incomplete or fuzzy.
The ability of solving problems can be enhanced by learning for years and practical training.	The ability of solving problems can be enhanced by adjusting with current situation or by adding new rules for new environment.	The ability of solving problems can be enhanced changing the program code.

- *Autonomous drones:* Unmanned aerial vehicles (UAVs) – which is commonly known as drones is, for example, system of military operation. Several nations have a different definition of what should be called autonomous drones. In 2013, US Air Force studied and said that studied and found no difference between manned and unmanned aircraft pilots. RPAS operators deep monitoring are a need in order to make an appropriate system, said of U.K. armed forces in 2017. [5]. But same as automated weapons, automated drones are also a topic of controversy whether they should be banned for ethical issues.

B. *Expert decision making*

To make artificial intelligence truly useful in the practical field of military it should have the ability to take an expert decision in any complex situation. To take any expert decision, it is required to build an expert system. The difference between human intelligence, expert system, and conventional system are as follows-

Table-1 Difference between human intelligence, expert system, and conventional system [25]

A realistic useful AI should both model and imitate the military decision at various stages [7]. It is necessary to identify, collect, and integrate the system with the knowledge that people use to solve problems. This process of gathering knowledge and integrating them to take a proper decision is called knowledge acquisition (KA) [6]. In military operations, knowledge superiority requires awareness and proper visualization of the main real-time battlespace. This decision-making systems can help militaries in making any critical decision in a complex situation during operation. For this, knowledge-based decision-making ability is highly needed. In 2009, an incident happened called ‘miracle on the Hudson’. US Airways Flight 1549 faced an emergency situation and had to take emergency decision to drain the system or try to land. For the lack of engine power, the aircraft was unable to reach any nearby airport. Then, it had to land on the Hudson River [9]. The landing of this flight is an example of knowledge-based intelligence [4]. It is highly needed that to ensure the KA of the system is proper and perfectly done. Any gap in this KA can provide wrong decisions and this can lead to a great disaster situation in operation.

C. *Prediction of enemy actions*

The feasibility of "reading the mind of an enemy" is being investigated by the Defence Advanced Research Projects Agency (DARPA) Real-time Adversarial Intelligence and Decision-making (RAID) program. This investigation is being done to estimate enemy's probable goals, positions, movements, descriptions, and actions. This RAID program is using description-sensitive algorithms to provide a real-time estimation. They are also doing realistic experimentation and real-time evaluation to develop the system processing and to compare humans and the RAID system. In 2005, two experiments were done to test the effectiveness and accuracy of the system compared to human intelligence. The result of this tasting ends in the decision that the RAID predictions are as much accurate and effective or even on average more effective than a 4-person experienced staff and There is a statistically relational evidence of that [3]. Long Range Anti-Ship Missile (LRASM) uses its own sensors and computers to get data to take a decision and differentiate enemy ship [24]. Proper estimation of enemy goals and objectives can help a lot during operations.

D. Technical factors

The use of artificial intelligence in military operation requires a system properly learned with qualified data and able to handle changeable environments. At the same time, the hardware of the system also must be supportable and survivable on the battlefield. Along with the smart functionality, the design of the device should also be reliable and should be able to take real-time data from the environment easily. One design approach is to use a set of inference engines in a loosely coupled architecture which will be operating together [10].

2 Adaptation Problems and Threats

In the military operation, the use of artificial intelligence is huge. AI is serving in a different way to help militaries during operation such as autonomous system, expert decision support system, battlefield information prediction etc. As AI is being used in a very important field like military, the maintenance and creating of the system must be considered carefully. The main problems faced in adopting AI in military operations are Ethical issues in the application of autonomous system, costs and people's opinion about adopting AI in warfare which is shown in figure 2.

Figure 2. major adaptation problems faced in military operation field.

C. Ethical issues for Autonomous systems

For an autonomous system which is engaged in a task where safety is the main thing such as weapons release, the key question then arrives whether the system can resolve ambiguity in order to achieve an acceptable result. The ability to form general rules from a certain domain of information requires visual and moral judgment. Computer algorithms are especially data-driven typical algorithms that includes the category of AI. Which means that the algorithms are not able to generalize and can only consider the fixed variables which are identified when the algorithm is coded. There is significant research is going to change this [4]. But the big question arrives here whether we should depend on a machine and allow to take such important decisions. An algorithm may have a high probability of giving correct decisions but it is still a probability. Taking someone's life during an operation cannot be set under a probability by lying on an autonomous weapon. Many arguments have been made for and against adopting autonomous weapons. The replacement of human soldiers by a machine during operation is good in that sense that may reduce the risk of human lives, but the bad part of this is lowering the ambit for going to battle [11]. The use of autonomous and semi-autonomous weapons was issued a connotative ban by the U.S. Department of Defence [13]. **Lethal autonomous weapons** (LAWs) is an autonomous robot invented to target and attack during wartime without having any direction from human. These robots are then labeled as 'killer robot'. The autonomy of current system as of 2016 is restricted with the fact that the final decision of attacking must be given by human [8].

D. Cost issue

Heavy investment is a main criteria for artificial intelligence in conducting research, inventing advanced algorithms and hardware infrastructure [17]. To build a system that is artificially intelligent, it is necessary to run the system with lots of possible proper information. Training a system is very costly and when the place is to apply AI in a military operation, a proper and expert system is needed. According to a Pentagon press release, Six3 Advanced Systems was given a contract of $10 million to design, develop and evaluate a system working for a combinational military force. This system architecture and software combines humans and unmanned intelligence [12]. It is said by Deputy Defence Secretary of US Department of Defence that in order to make a better and reliable autonomous weapon with proper and appropriate intelligence, U.S. military aims to budget more money in this area [16]. In February 2016, President Obama unveiled the federal government's Fiscal Year 2017 budget. On that budget, $4.457 billion was allocated to the US Department of Defence for drones [15]. US Department of Defence is spending a lot of money to improve the military operation condition using all new technologies and AI is the basis of this. U.S. DoD is working and spending money to make artificially intelligent machines to both help in the operation and also to conduct operations automatically. Here is a chart of budget for making artificially intelligent systems-

Table 2. Budget summary for autonomous drones in The Fiscal Year 2017 Defence [15].

Autonomous drone name	**Cost in dollar**
MQ-9 Reaper	$1.2 billion
RQ-4 Global Hawk	$305 million
MQ-4C Triton	$944.1 million
MQ-8C Fire Scout	$119.5 million
MQ-1C Gray Eagle	$148.4 million
Unmanned Undersea Vehicles	$325.9 million
Unmanned Ground Vehicles	$74.2 million

The primary motivation for creating an artificially intelligent system is to minimize the cost. As a result, a complete and properly workable artificially intelligent application for military operation may decrease the overall cost. At the same time, failure of inventing an expert system may increase the cost too much.

E. People's opinion

People have mixed opinion on the topic of adopting AI in the military field. Creating autonomous robot is now a big controversial topic. People are thinking that creating more artificially intelligent and autonomous systems will create a risk in their job career. Two-thirds of Americans believe that robots with AI will perform most of the work that is being done by human now in the next 50 years. It is also believed by the 80% of that people that, their job will not be affected in this period of time. In a recent report of World Economic Forum published their opinion of prediction about this matter. They said that automatic robots will take 5m jobs around 15 different developed nations within 2020 [18]. The increasing use of artificial intelligence in military operation may also create a problem for the military who has been being trained for military operations. Stephen Hawking commented about the threat of AI that, computers can emulate even can exceed human intelligence and for this, our society

could be destroyed by AI as it may have the ability to take positions of humans [19]. Microsoft co-founder Bill Gates said that people are not concerned about the fact that an artificial super-intelligence may save or destroy human civilization by mid-century [20].

3 Drawbacks and Solutions

Any system which is being invented with artificial intelligent must be considered very carefully. Before making any machine intelligent like humans, the impact of the invention must be considered with importance. Military operation is a big and important issue for every country. The cumulative use of AI and military operation can produce a great thing and could help to make a revolutionary change in military operation if the impact and use of it are analysed correctly.

F. Focusing area

The current use of Artificial Intelligence in military operation is mainly focusing on the automation of military operations with artificially intelligent robots and drones. The focusing view are shown in a diagram in figure 3 which reflects the main aspects of military fields incorporating AI. US DoD is spending a lot of money every year for the research, development, and invention of algorithms aiming to conduct autonomous operations. They are trying to develop autonomous military robots from an automatic system. Military unmanned drones for bomb disposal has also become an important area to focus on. Though this field of research and invention may bring a revolutionary change in the operation, the future and further impact of this is not been concerned. In July 2016, a "crime-fighting robot" which was created by platform Knightscope crashed into a child in a Silicon Valley mall [21]. Automatic bomb disposal robots can also be a threat if someone uses this for negative intentions. All these future impacts including good and bad side should be considered before the invention of creating an intelligent system to make a proper use of the technology for a long time without affecting other issue.

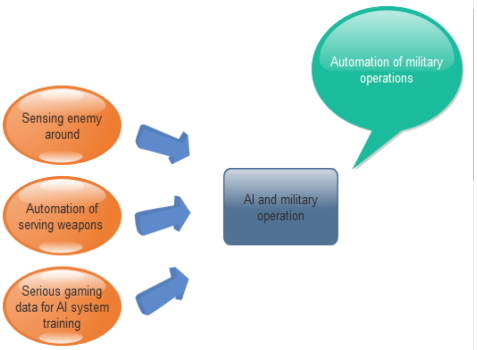

Figure 3. Focusing view of using AI in the military operation

- *Serving weapons:* If the focusing area of using AI in military operation can be diverted from autonomous conduction of operation to a better scope place then this may make the best use of AI without creating any other problems. Among all of these scopes, one may be considered as focusing and increasing the use of AI to serve weapons to military in an automatic and effective way. Military drones are now using AI in order to deliver bombs in battlefield conditions to conduct very complicated and complex battle land condition. But the drones are still using an automatic system not autonomous system. That means the drones are still remotely controlled by human beings [20]. A complete autonomous system in this field which can sense the need and can deliver weapons autonomously adopting effective way, could bring a huge change in operation and could be very helpful for the militaries.

- *Sensing enemy around:* Another issue that can be a focusing area for using AI rather than making operations autonomous is sensing the presence of enemy around during wartime. This may also be used as a great helping hand for the military. Creating an artificially intelligent machine or device which can give warning sensing around a limited place may help the military to be aware of the back attack. In order to build such AI system, it is highly needed to analyze, research and develop an algorithm which can differentiate enemy by sensing their behaviour.

G. Knowledge Engineering

Knowledge Engineering is one of the most critical obstacles in order to develop an intelligent decision support system [8]. Training the system with proper data is also a challenge to make the system work intelligently. Getting proper data and training process cost is too high. For this, extracting the data from serious gaming while tanning the military to make an AI system that would be used for military operations can be a solution.

- *Serious gaming:* Serious gaming is a game that has been designed as a professional gaming tool. Militaries conduct serious gaming in training purpose. They are also using this gaming to predict a military's expertise level. One of many powerful simulation tools was used for military training is Topscene [22]. Nowadays, virtual reality games are being used by military for training which helps to reduce the cost of the training process. [23]. These training process could be done by dividing the whole team into two sections and assuming one as the enemy team of other. From this type of games, data could be extracted and could be used in knowledge enhance the process of the AI-based system for better decision making by predicting enemy actions during operation.

4 Conclusion and Future work

Artificial intelligence is a technology that is being used increasingly to make systems which can think, take a decision and conduct work like humans. Now AI is being used in many sectors successfully. Since the invention of the AI, the use of this technology is increasing till now. The AI technology is now a rising topic in the field of military. They are using artificially intelligent systems in many different phases of military such as training, operation, expert decision making etc. In the field of military operation, AI is playing a vital role. Autonomous conduction of operations, expert decision-making ability during wartime, giving a prediction about the enemy actions and also predicting enemy nature and attacking technology are the areas in which people are doing research to invent and develop these type of systems with advanced artificial intelligence.

Artificial intelligence in this field also has some technological factor to be considered and also some adaptation problems. The problems of adopting AI in military operations must be considered first to develop an AI-based system. From the literature review of using AI system in military operation, it has been found that the use of AI in this field is mainly focusing on the automation of operation. But the concept of this automation system has some major problems which must be considered giving more importance. Thus the major focusing point should be changed in other directions in order to make the best use of AI system in military operation. Some arrears in the military operation where an AI-based system can be implemented for better use such as serving weapons to military autonomously and effectively, sensing enemy around and using serious gaming data to train AI based system while military training are

being conducted. These fields also have been mentioned with description in this paper.

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5 References

[1] (17 April 2017). *A Brief History of AI*. Available: https://aitopics.org/misc/brief-history.

[2] (7 September 2017). *Artificial Intelligence and the Military*. Available: https://www.rand.org/blog/2017/09/artificial-intelligence-and-the-military.html.

[3] M. Ownby and A. Kott, "Reading the Mind of the Enemy: Predictive Analysis and Command Effectiveness," *Ccrts*, 2006.

[4] M. Cummings, "Artificial Intelligence and the Future of Warfare," *Chatham House*, January 2017, 2017.

[5] (28 July 2017). *Autonomous military drones: no longer science fiction*. Available: https://www.nato.int/docu/review/2017/Also-in-2017/autonomous-military-drones-no-longer-science-fiction/EN/index.htm.

[6] M. BOWMAN, G. TECUCI and M. CERUTI, "APPLICATION OF DISCIPLE TO DECISION MAKING IN COMPLEX AND CONSTRAINED ENVIRONMENTS," *Ieee, (0-7803- 7087-2/0)*, 2001.

[7] M. Pelosi and M. Brown, "Software engineering a multi-layer and scalable autonomous forces "a.i." for professional military training," in *2016 Winter Simulation Conference*, 2016, .

[8] Anonymous "MACHINE LEARNING FOR MILITARY OPERATIONS," *Rome Laboratory Air Force Materiel Command*, July 1997, 1997.

[9] (17 October 2017). The United Kingdom and Unmanned Aerial Vehicles: A Summary of Joint Doctrine Publication 0-30.2. Available: https://www.lawfareblog.com/united-kingdom-and-unmanned-aerial-vehicles-summary-joint-doctrine-publication-0-302.

[10] L. Morcerf, K. Kontson and J. Clema, "A CONCEPT FOR THE APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGY TO BATTLEFIELD SPECTRUM MANAGEMENT," *Ieee*, 1987.

[11] (28 July 2015). *AUTONOMOUS WEAPONS: AN OPEN LETTER FROM AI & ROBOTICS RESEARCHERS*. Available: https://futureoflife.org/open-letter-autonomous-weapons/.

[12] (15 June 2017). *US military will have more combat robots than human soldiers by 2025*. Available: https://nypost.com/2017/06/15/us-military-will-have-more-combat-robots-than-human-soldiers-by-2025/.

[13] (3 August 2015). Military Robots: Armed, but How Dangerous?. Available: https://www.technologyreview.com/s/539876/military-robots-armed-but-how-dangerous/.

[14] (5 Aug 2015). *Warfighting Robots Could Reduce Civilian Casualties, So Calling for a Ban Now Is Premature*. Available: https://spectrum.ieee.org/automaton/robotics/artificial-intelligence/autonomous-robotic-weapons-could-reduce-civilian-casualties.

[15] D. Gettinger, "Drone Spending in the Fiscal Year 2017 Defense Budget," *Center for the Study of the Drone*, February 2016, 2016.

[16] (14 December 2015). *The Pentagon wants at least $12 billion to fund AI weapon technology in 2017*. Available: http://uk.businessinsider.com/the-pentagon-wants-at-least-12-billion-to-fund-ai-weapon-technology-in-2017-2015-12?r=US&IR=T.

[17] (17 April 2017). *How to Fail with Artificial Intelligence*. Available: https://medium.com/money-

talks-the-official-abe-blog/how-to-fail-with-artificial-intelligence-b3c4b1966bb3.

[18] D. Shewan, "Robots will destroy our jobs – and we're not ready for it," *The Guardian*, 11 January 2017, 2017.

[19] (20 October 2016). *Stephen Hawking says artificial intelligence could DESTROY society by taking over humans*. Available: http://www.mirror.co.uk/news/uk-news/stephen-hawking-says-artificial-intelligence-9086652.

[20] (29 October 2015). *We All May Be Dead in 2050*. Available: https://www.usnews.com/news/blogs/at-the-edge/2015/10/29/artificial-intelligence-may-kill-us-all-in-30-years.

[21] (2 December 2016). *Top 10 AI failures of 2016*. Available: https://www.techrepublic.com/article/top-10-ai-failures-of-2016/.

[22] M. MACEDONIA, "Games Soldiers Play Games Soldiers Play," *IEEE Spectrum*, March 2002, 2002.

[23] (8 Feb 2017). *Virtual Reality Games Fuel a Military Training Revolution*. Available: https://www.govtechworks.com/virtual-reality-games-fuel-a-military-training-revolution/#gs.D8KOPjU.

[20] (1 Jun 2016). *Why Should We Ban Autonomous Weapons? To Survive*. Available: https://spectrum.ieee.org/automaton/robotics/military-robots/why-should-we-ban-autonomous-weapons-to-survive.

[25] (2011). *Rule-Based Expert System*. Available: http://www.pearsoned.co.uk/HigherEducation/titlesby/negnevitsky/

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Exploring Review Sentiment Expression for Predicting Review Rating

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Abstract- This paper explore the review text for predicting rating where review sentiment is analyzed. The linguistic inquiry word count (LIWC) tool is used for sentiment analysis and classification methods: Support Vector Machine (SVM), Logistic Regression (LR), and Naive Bayes (NB) are applied to predict rating. Our experiment shows that the logistic regression (LR) model provides the best performance than others.

Keywords- Sentiment analysis, review rating, classification.

I. Introduction

Nowadays, analysis of sentiment for predicting review rating has been extensively studied because online reviews usually contain customer sentiment and views that are fundamental to many decisions-making processes. For example, a customer doesn't know how to take the best product or avoid the poorer product from all kinds of products when they all belong to the positive/negative sentiment polarity. Besides, it ignores to meet the specification for mining fine-grained classification. Therefore, this suggests that predicting product ratings may contribute to change in product sales.

The existing literature shows various methods to predict the review rating from the history of review text, where different sentiment scores are used to express different sentiment intensities. It is observed that existing studies on the review text mainly transform review text into feature vectors and employed different machine learning techniques to predict review rating. Additionally, review texts have an implicit hypothesis that the sentiment magnitude given by various users employing the same sentiment words is consistent, and the sentiment magnitude given by different sentiment words is unusual. However, this implicit hypothesis does not match the exact case. Thus, it raises some questions:

1) whether the review sentiment and rating align with each other,

2) How does review sentiment and rating preference affect the performance of our methods than the benchmark method?

To address the above research questions, we make the following contributions in this work:

- We calculate the overall sentiment score for predicting review rating.
- We integrate different features from review text with sentiment score for predicting accurate rating.
- Our comparative results on drug review shows that LR provides significantly better performances than SVM and NB.

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The rest of part is covered as follows. In Section 2, we describe the main part where we provide feature extraction, and sentiment analysis for predicting review rating. We also highlight the evaluation matrics and summarize the various classifier results. In section 3, we conclude the paper and point out the future research direction.

II. Review Rating Prediction

A. Problem Definition

Given a set of patients review on N physical and mental conditions of D drug where each condition expressing as C = c1,c2,c3,c4.....c_n and patients P = p1,p2,p3,p4.....p_n. The patients have provided S reviews R = r1,r2,r3,r4.....r_t on N conditions. The primary goal is to predict the rating of each review in R = r1,r2,r3,r4.....r_r based on patients sentiment expression.

B. Feature Extraction

The following section describe more details about Count vectorization and TF-IDF respectively.

Count Vectorization: The CountVectorizer weapon from the sklearn feature extraction represents its own internal normalization and tokenization techniques. The method of the vectorizer expects an iterable list of rows and columns to make a dictionary of the vocabulary on the corpus. Each separate document transform into a sparse array whose index tuple is the row (the document ID) and the token ID from the dictionary.

TF-IDF: Tf-idf is set for term frequency-inverse document frequency. Tf-idf can be well used for stop-words filtering in different subject fields, consisting of text summarization and classification. Generally, the tf-idf value is formed by two terms: Term Frequency (TF) and Inverse Document Frequency (IDF). All terms are given a value by TFIDF, which is measured as in Equation 1.

$$tfidf(t,d,D) = tf(t,d) * idf(t,D) \quad (1)$$

Where t defines the terms; d defines each document; D defines the collection of documents. To transform the tweets into a matrix of TF-IDF features, we used sklearn feature extraction Python library.

C. Sentiment Analysis

Sentiment analysis is conducted to represent a user's own point of view on items. To get the correct sentiment score from our dataset, linguistic inquiry word count is used. Then, sentiment score is measured by the sum of the positive or negative score divided by the total of score. The equation can be viewed in Equation 2, 3, 4, and 5.

$$Positive\_Score = \sum_{j=1}^{n} pos\_score\_senti(i) \quad (2)$$

$$Negative\_Score = \sum_{j=1}^{n} neg\_score\_senti(i) \quad (3)$$

$$Total\_Score = Positive\_Score + Negative\_Score \quad (4)$$

$$Senti\_Score = \begin{cases} \frac{Positive\_Score}{Total\_Score} & \text{If } pos > neg \\ \frac{Negative\_Score}{Total\_Score} & \text{If } neg > pos \\ Neutral & \text{If } pos = neg \end{cases} \quad (5)$$

D. Evaluation Matrics

In order to evaluate the performance of various classifiers, we use precision, recall and f-score. The following equations are provide how precision, recall and f-score are calculated, respectively.

$$Precision = \frac{t_p}{t_p + f_p} \quad (6)$$

$$Recall = \frac{t_p}{t_p + f_n} \quad (7)$$

$$F - Measure = 2 * \frac{precision * recall}{precision + recall} \quad (8)$$

where true positive defines as t_p, false positive defines as f_p, and false negative defines as f_n respectively.

E. Results

In this study, we applied three well-known classifiers such as, SVM, LR, and NB. In order to compare the performance of various methods, we performed an extensive experiments on patient drug reviews. We collected our dataset from kaggle.com. It provides user reviews on individual medicines along with similar condition and a 10 star user rating reflecting overall user satisfaction. We obtained three level polarity labels for comprehensive patient satisfaction. Considering the whole feature values, dataset was divided into training and test where we randomly picked 60% of the data for training purposes. On the other-hand, we use the rest of 40% data for testing the classifiers. Table 1, shows the results of sentiment evaluation and the values of precision, recall, and f-score of SVM, LR, and NB. We observed that LR classifier provided better performance than others.

TABLE I

PERFORMANCE COMPARISONS OF DIFFERENT CLASSIFIERS FOR PREDICTING REVIEW RATING

Features	Methods	Precision	Recall	F-Score
Doc2Vec	LR SVM NB	0.75 0.87 0.68	0.76 0.86 0.68	0.75 0.87 0.67
TF-IDF	LR SVM NB	0.69 0.72 0.69	0.70 0.73 0.63	0.69 0.72 0.69
Doc2Vec+ Sentiment	LR SVM NB	0.49 0.46 0.42	0.52 0.57 0.44	0.49 0.55 0.40
TF-IDF+ Sentiment	**LR** SVM NB	**0.62** 0.49 0.36	**0.56** 0.51 0.35	**0.51** 0.47 0.21

III. Conclusion and Future Work

In this study, first, we analysis the user's sentiment expression using our review text content. Second, considering the user-personalized information, we analyse user-item review text and rating matrix. Finally, we linearly integrate the review text content, user's sentiment, and user-item rating matrix information to achieve review rating prediction. Experimental results on our dataset show that LR classifier has better performance. In the future, we would like to use deep learning to detect suspicious or fake online reviews and create proprietary ranking scale (5-star) for more precise user's feedback representation.

REFERENCES

[1] Islam,M.R.,Liu,S.,Biddle,R.,Razzak,I.,Wang,X.,Tilocca,P.andXu, G., 2020. Discovering dynamic adverse behavior of policyholders in the life insurance industry. Technological Forecasting and Social Change, p.120486.

[2] Y. Zhang et al., Explicit factor models for explainable recommendation based on phrase-level sentiment analysis, in Proc. 37th Int. ACM SIGIR Conf. Res. Develop. Inform. Retrieval, 2014, pp. 8392.

[3] X. Lei and X. Qian, "Rating prediction via exploring service reputation," in Proc. IEEE 17th Int. Workshop Multimedia Signal Process., Oct. 2015, pp. 1–6.

[4] Islam, M.R., Liu, S., Wang, X. and Xu, G., 2020. Deep learning for misinformation detection on online social networks: a survey and new perspectives. Social Network Analysis and Mining, 10(1), pp.1-20.

[5] M. Taboada, J. Brooke, M. Tofiloski, K. Vol, and M. Stede, Lexiconbasedmethods for sentiment analysis, Comput. Linguistics, vol. 37, no. 2, pp. 267307, 2011.

[6] Wang, B., Xiong, S., Huang, Y. and Li, X., 2018. Review Rating Prediction Based on User Context and Product Context. Applied Sciences, 8(10), p.1849.

[7] Ganu, Gayatree, Yogesh Kakodkar, and Am´eLie Marian. "Improving the quality of predictions using textual information in online user reviews." Information Systems 38.1 (2013): 1-15.

[8] Li, F., Liu, N.N., Jin, H., Zhao, K., Yang, Q. and Zhu, X., 2011, June. Incorporating reviewer and product information for review rating prediction. In Twenty-Second International Joint Conference on Artificial Intelligence.

[9] Islam, M.R., Kabir, M.A., Ahmed, A., Kamal, A.R.M., Wang, H. and Ulhaq, A., 2018. Depression detection from social network data using machine learning techniques. Health information science and systems, 6(1)

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Maurya and Jocasta as the Mother, Better Half and Human Being: A Study

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Abstract

Maurya is the protagonist of the one-act play 'Riders to the Sea' by John Millington Synge. On the other hand Jocasta is the mythological character of 'King Oedipus' by Sophocles. Both of them are women but lives in the different poles regarding their position, situation and noble womanly deeds. Maurya's sufferings are for the great or noble causes while Jocasta's suffering is for the cause of the sin of self-blindness. Maurya is the wife to a fisherman while Jocasta is the wife to Laius, the king of Thebes. Mortality and powerlessness of human being is the depiction of J.M. Synge and Sophocles.In spite of that we have conscience. The fact is that who has used his or her conscience to be saved from the destruction of the world and hereafter is the focal point of human victory. The aim of this paper is to find out who is the better woman between the two feminine characters created by Synge and Sophocles in spite of happiness or sadness so that the readers can get a clear and pure way to judge and lead their lives because two roads cannot be taken at a time on Earth. This paper also attempts to clarify the standpoint of the ladies as Mother, Wife, Guardian and Human being.

Key Words: Maurya, Jocasta, Better, Position, Tragedy

Introduction

'Riders to the Sea' was written in the middle of the Irish Literary Renaissance, a movement in which Synge, along with William Butler Yeats and Sean O'Casey, was a leading figure. The Renaissance was triggered by resurgence in Irish pride in their identity and culture, as well as efforts to keep the Gaelic language alive, such as the founding of the Gaelic League in 1893. Writers and scholars developed a particular interest in the histories, legends and folktales of Ireland, and this was entwined with a changing political mood, as there was a desire to "de-Anglicize" Ireland, which was still under British rule. Thus, the Irish Literary Revival stirred nationalist sentiment and spread the desire for Irish independence from Britain in the years leading up to 1919 when the Irish War of Independence against the ruling English officially commenced.(Vila:2017)Maurya and Jocasta are the two real tragic characters according to order created by J.M. Synge and Sophocles. Their social position is different from each other. Their plot of sufferings is also from different dimensions. Maurya has two daughters named Cathleen and Nora. She has six sons named Michael, Sheamus, Stephen, Patch, Shawn and Bartley. She is really an example of lofty tragic figure who does not suffer for her fault. Rather, she is the victim of circumstances. She was happy with her husband, her father in law, her sons

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and daughters. She has lost all and leads her life with a great sorrow. She says:

"I've had a husband, and a husband's father, and six sons in this house-six fine man, though it was a hard birth I had with every one of them… there were Stephen and Shawn were lost in the great wind, and found often in the bay of Gregory of golden Mouth…"

[Riders to the Sea, 21st dialogue of Maurya]

As she lost her husband and husband's father and five sons, she does not allow Bartley to leave her. She wishes him to stay before her. She does not want anything more in her life than this. She does not want him to go Connemara. But Bartley does not hear her. He does not care and evaluate the earnest message of his mother's soul. Maurya tells to him:

"If it was a hundred horses, or a thousand horses you had itself, what is the price of a thousand horses against a son where there is one son only?"

[Riders to the Sea, 6th dialogue of Maurya]

She leads a poor life but holy. She always prays and cries to God for her sons' and daughters' welfare. She leads a pure life though in sadness. Misery has its end with a light of hope.

It is the common system of nature that the old will leave the world and the young ones maintain all the things. But in case of Maurya the scenario is different. She is alone in a wide sea of sorrow with her two daughters Nora and Cathleen. All the burden of life is on her head in this old age like the pain of the old grandfather in the poem 'Grave' by Jasimuddin, a Bangladeshi rural poet, losing all the nearest and dearest ones. Her echo of pain moves all over the world through the following speech in 'Riders to the Sea':

"In the big world the old people do be leaving things after them for their sons and children, but is this place it is the young men do be leaving things behind for them that do be old."

[Riders to the Sea, 13th dialogue of Maurya]

But Maurya's mental strength is high. She is not frustrated. She has minimum level of satisfaction as Michael has a clean burial and Bartley will have a fine coffin. What more can she expect more than this on this earth or from the cruel man like Bartley not hearing even her request? She does not want to leave the earth so easily like the old grandfather. She has a real consolation of sustaining on earth because everyone must die today or tomorrow. None can live forever. In her last dialogue she states:

"Michael has a clean burial in the far north, by the grace of the Almighty God. Bartley will have a fine coffin out of the white boards, and a deep grave surely. What more can we want than that? No man at all can be living forever, and we must be satisfied."

[Riders to the Sea, 28th dialogue of Maurya]

On the other hand, Jocasta is the better half of the royal family of Thebes. She has a child named Oedipus. She has four other children named Ismene, Antigone, Eteocles and Polyneices. The sons and daughters except Oedipus are from the second husband Oedipus. She lives in the light of aristocracy though in darkness. She herself destroys her son's life because of her callousness. Jocasta leads a sinful life though in happiness. Sinful life just leads the sinners toward the destruction.In 'Riders to the Sea' the protagonist Maurya plays a very strong

role as a wife , a guardian, a better woman and of course a good mother. She attempts to save her sons from every danger giving her best, it does not matter that she gets success or not. Her mentality makes her better woman and better example of an ideal mother than any other. She presents a persevering character till the last moment here unlike the character, Jocasta in ' King Oedipus '. Queen Jocasta is also a mother and wife but she does not present the actual attempt that she needs to do in her position. Yes, there is a attempt that she and her first husband do together at the very beginning giving up their own son in order to save king's life. But after that being over confident she completely forgets the prophecy and does the most unexpected thing that she should not ever and becomes a great sinner in the state. If she really wants to stop the unpleasant incident, she obviously refuses to marry with the boy like her son. Besides, fate is also a big issue here to change all the attempt of human being in both 'Riders to the Sea'and ' king Oedipus'. In Riders to the Sea, the sea represents fate. The sea provides livelihood to people as it does to Maurya's family too. We can say that Maurya is fated to suffer at the hands of sea. The ruthless and cruel hand of Maurya's fate forcibly leads Bartley to her son, Bartley's death to complete her tragedy. (Ahmed: 2015).But at the end Maurya is recognized as the universal character because of her perseverance and having wishes for the people of the whole world from her great heart.

'May the Almighty God have mercy on Bartley's soul, and on Michael's soul, and on the souls of Sheamus and Patch, and Stephen and Shawn (bending her head); and may He have mercy on my soul, Nora, and on the soul of every one is left living in the world.'

[Riders to the Sea, 27th dialogue of Maurya]

She as a mother has to undergo the intolerable pain and grief of losing all of her sons. Despite all she is "so firm set and integral in her nature that in spite of all its victory over her she is still herself" as Daniel cookery remarks. (Enam:2014). From the play 'King Oedipus', it is evident that Oedipus has no control over his life – some divine power seems to control his destiny. The prophecy of the gods must come true and no human being, not even the kings, can prevent it from occurring. (Kaufmann:1992), (Berg &Clay: 1988). At last she doesnot give theeffort as a queen of a state or a wife or a mother .Her character shows a shadow of loser who commits suicide. This step makes the character weak and conflicted whereas Maurya determines to remain her family safe anyhow.

I. Literature Review

Maurya is the lady who always wants happiness of her family and for that she prays to god every single moment. She is really an excellent mother who tries her best till the last moment of her last son, Bartley's departure. Just after losing Michael in the sea she only thinks that he may come back one day to her. But the reality is not so kind , actual reality is that Michael never comes back . During passing this sorrowful time he wants to save her last son, Bartley by hook or by crook. She tries to stop him to go to Connemara how much she can. At the end she is not able to stop him by her lots of requests and tears. She even does not give her blessing him for not to listening her . Later, her two daughters, Nora and Cathleen send her for giving cake to Bartley but again she fails to bless him and he departs. After that she

passing ever single moment praying for her children to god and gets her son back anyhow . Once she notices that he passes and the ghost of Michael is just behind him which is a unlucky sign to him, being a common mother still now she is praying for her family and not only her family but also the rest people in the whole world and this feature makes her the universal mother. Actually she is the pure soul and also has the extra ordinary power to think about the happiness of the whole world after getting the symbol of her last son's death. She transforms herself from an individual mother to a universal mother. Moreover, she is an idol of patience- she does not break down; suffering a long way of grief, she utterly surrenders to the fate. (Ali:2014). There is also the concept of OedipusRex in the relationship among Maurya and her sons that represents theattachment ofthem. But their relationship is not exactly like the relationship between Jocasta and Oedipus, they continue a common , pure and deniable relationship from nature of motherhood.

But as a member of a royal family and being a queen of Thebes it is Jocasta's duty to be more strict and judgmental to take any decision that she is not seen. When she and her first husband get the prophecy , both of them decide to leave their first child that never can be a logical solution anyhow. Though they put away their child , later as a mother, she never even tries to find out him. This attitude never prove her as a good mother where Maurya is noticeable as a universal mother for her concern.

The character of Maurya as a wife In the Riders to the Sea is not seen so long time , but it is clear here that she is also an example of ideal wife like a ideal mother . Both the death of her children and her husband break her heart. On the contrary, Jocasta plays along role as wife twice in her one life. After her first husband's death by his son, Oedipus she again gets married with her own son without knowing the truth that is the biggest mistake of her. Yes, it is true that she has no idea about the real identity of Oedipus so that she can stop the great sin but she is acknowledged about the prophesy from the very beginning. After knowing the unpleasant truth she could give up her new born baby to avoid first husband's death but she agrees to marry with the boy who is aged like her son and kills her husband. She has nodoubt about all the incidents happening anytime. Even she passes her married life happily with her son and also spends intimate moments with her own son . According to many scholars, this typesof complex relationship of Jocasta and Oedipus has created a term named “Oedipus Complex" where male child has anunnatural relationship with itsown mother. In the case of Jocasta I have advanced the hypothesis that her ostensible role as an unsuspecting mother may well be a facade, that Sophocles embedded enough information and ambiguities in Oedipus Rex to allow for this interpretation . (Bross: 1992).

The Riders to the Sea is the perfect masterpiece of tragedy. Here the protagonist Maurya is the tragic character who always suffers struggles with her problems lonely. She is the only guardian of her family after the death of her husband and father in law. She leads her poor family with six sons and two daughters tolerating many troubles in life. Her family is everything for her and she is ready to do anything for them. But for her bad luck she loses herbeautiful family. She loses her sons unfortunately but at the last moment she remains very strong and

faces her all bad lucks gradually. Maurya's final words that "no man can be living for ever, andwe must be satisfied with that," cleanses our mind through a cathartic effect. We feel 'calm of mind, all passions spent.' This is why Riders to the Sea is a truly great tragedy of lower level in modern literature, and Maurya is an exceptional tragic heroine. (Dutta: 2010). In many ways, Maurya is a tragic hero. In Greek drama, a tragic hero is someone destined by the gods to a tragic fate; try as the hero might, there is nothing he or she can do to alter this fate. When the play opens, Maurya has already lost her husband, father-in-law, and four of her six sons to the sea. In many ways, Maurya is a tragic hero.

In Greek drama, a tragic hero is someone destined by the gods to a tragic fate; try as the hero might; there is nothing he or she can do to alter this fate. When the play opens, Maurya has already lost her husband, father-in-law, and four of her six sons to the sea. (Bruce: 2016) After trying so hard she just fails in her attempt. The struggles of her whole life go in vain and has to see most of the family members' death. Unlike queen Jocasta she does everything to save her sons but the misfortune does not go far from her and she becomes the tragic character in Riders to the Sea.

On the opposite side, queen Jocasta is the queen of Thebes who always leads a luxurious life in the royal palace. She has the every kinds of benefits in her life but she and her husband, king Laius are not happy for the lack of a child . Though they get a male child but they are bounded to keep him away from them in order to avoid king's death. But all the attempts are failed eventually Oedipus meets with his father and after killing him weds to own mother, queen Jocasta. After that, lots ofanarchy occurs in the country for this great sin and when Jocasta understands the entire matter she suicides and her life comes to the end. She faces many ups and downs in her short life and it seems that she may be responsible for her downfall somewhere or somehow. If she disagrees to leave her child or refuses to marry with her husband's murderer then all the disasters could be avoided.(Slattery:2012.) Queen Jocasta and Maurya, both of them are fully blind in superstition. Maurya represents her supertitious mentality many times. If she sees any unpleasant matter with her family specially her sons before going to the sea, she gets easily afraid of their journey. Believing her vision to be a supernatural omen, Maurya predicts that Bartley will be lost at sea. Tragically, she is right. Clearly, superstitions play a key role in the narrative of Riders to the Sea as they generate the mystery and suspense which add to the overall effect of the drama. (eNotes Editorial:2017). Similarly, If Jocasta would not believe in superstition badly and would not leave Oedipus in his childhood may be the sins and disasters could be controlled. Actually on the other view, Jocasta is the victim of her fate where she has nothing to do at all. In Sophocles' Oedipus the King, the theme of fate versus free will appears often throughout the play. It is prophesied to Oedipus's parents, Jocasta and Laius that their son would grow up to kill his father and marry his mother. Diana McHugh addresses the concept of fate by writing,

Their attempt to assert their free will is foiled when fate intervenes, in the form of the "good will" of a Shepherd who spares the infant's life. According to Alistar Cameron, Oedipus's fate is not complete before the beginning of the play. (Megan: 2015). Both free will and fate are responsible for the misery, but as a human

being no one should give up in life to the last moment.

Some authors also address the same thing. If Jocasta had not tried to cheat fate, perhaps King Laius would be the only dead. Instead King Laius and Jocasta are both dead, Oedipus is ruined and his children are cursed by this incestuous pollution. Fate is a force not to be reckoned with. (UKEssays:2018). Both of Jocasta and Maurya are just part of a fate game. They are the victim of their misfortune. They both cannotget whatthey want and have to accept the unpleasant consequence. But it does not mean that we should accept any prophecies and stay in a particular circle without doing anything. we must have to fight for ourselves because accepting fate is such a symbol of failure before fail like Jocasta fails in her life but losing all sons Maurya becomes the idol woman and unique example of a winner.

Between the two female characters, Maurya is better than Jocasta according to the overall study of the researcher's point of view. In every sphere Maurya plays more satisfying role than queen Jocasta as a mother, as a wife and also as a good human being or as a great lady. Maurya observes the reality that is occurring surrounding her. She has enough moralities and ethics to handle andface the tragic moments of life. On the other hand, queen Jocasta is not able to play the exact role thatshe actually should do in her life. She takes lots of wrong decisions and after that she has to pay for her flaws that always take her away from the actual reality and common way of life. She tries to change her fortune throwing away her own baby but she forgets no one can go over ones fate and everybody must face the result of fate that is already decided. As a human being, people can only attempt and work hard for the destination and all the processes have to be logical and honest not killing someone or trying to change fate doing good deeds and prayers.

Maurya, the universal mother follows the exact common nature of motherhood that makes her a great lady as the strongest example. Here Maurya is the poor lady who rears her children by herself even after husband's death. Her only goal is to save her family from every types of danger and this gives her the energy of tolerating all deaths and till the last son's death. She does not lose her willpower and mental strength. After seeing all male family members she keeps trying to make alive the last son, Bartley and requests him again and again not to go out in the bad weather. Though everyone knows about the death of Michael, she believes that he may return back him to her at anytime. Even knowing the certain death of Bartley she never stops praying and at the last part of the play she prays for the rest other dead and live people of the world. Unlikely, Jocasta is the royal lady and maintains a luxurious life with the knowledge of her duties and morality. But she does not play an ideal role being queen of Thebes or being a wife to a king. A queen must have enough knowledge about the realistic society and royal responsibilities than a typical lower standard woman. But it is really a matter of wonder that Maurya preserves more materialistic identity here.

The other dangerous side of Jocasta is that she is not truth seeker. Rather, she wants to live in a world of light and darkness. While Oedipus is in tension of seeking his birth root she tries to ignore that and live in the joyous way as she is at present. Here, we see, ethics is not evaluated that is the function of a cautious person. Some

dialogues of Oedipus and Jocasta clarify that:

"**Jocasta** (White with terror): What does it matter what man he means? It makes no difference now…Forget what he has told you…It makes no difference.

Oedipus: Nonsense: I must pursue this trail to the end, till I have unraveled the mystery of my birth.

Jocasta: No! In God's name- if you want to live, this must not go on. Have I not suffered enough?

Oedipus: There is nothing to fear. Though I be proven slave born to the third generation, your honour is not impugned.

Jocasta: Yet do not do it. I implore you, do not do it.

Oedipus: I must. I cannot leave the truth unknown.

Jocasta: I know I am right. I am warning you for your good.

Oedipus: My 'good' has been my bugbear long enough.

Jocasta: Doomed man! O never live to learn the truth!"

[*King Oedipus* by Sophocles, Lines 1085-1098]

Where losing all sons Maurya remains static, having a family only knowing a bitter truth Jocasta attempts suicide hanging herself. She gives only sorrowful and sinful moments to the readers with a royal background that is never expected from her at all. Being an uneducated typical lady, Maurya represents stronger character than Jocasta. Though Maurya loses her all dears and hopes, she is the role model to human for undeniable efforts and wills. On the contrary, Jocasta is not the perfect ideal woman or human being because of her cowardice behavior. Discussing all the natures of both characters it can be said that Maurya is more respectable who always fights and deals with unexpected problems than Jocasta who tries to flee away far from her own created problems at the time. Her last speech to Oedipus surprises the readers blaming only Oedipus for his damnation saying, "O lost and damned! This is my last and only word to you forever!"

References

[1.] Ali,M (2014).The charater of Maurya in the Riders to the Sea as a universal mother.https://malinotes.blogspot.com/2014/12/the-character-of-maurya-in-riders-to.html?m=1 . Accessed 31 August,2020.

[2.] Bross M, (1992). Jocasta and Oedipus.https://www.researchgate.net/publication/295855545_Oedipus_and_Jocasta. Accessed 31 August,2020. The Personal Mythin Psychoanalytic Theory (pp.161-181).

[3.] Smith A, White D, Hokanson C, Grant S, 2010. Situations of Pre-Competitive Stress of Young Italian´s Athletes. Journal of Sport Sciences 95: 633-637. doi: 10.1008/s00421-009-04965-7

[4.] Sami K, 2005. Factors affecting the educational development in severe obese children. PhD Thesis, University of Padua.

[5.] Kaufmann, W. (1992).Tragedy and philosophy. Princeton: Princeton University Press.

[6.] Sophocles, Berg, S., & Clay, D. (1988). Oedipus the King. United States: Oxford University Press

[7.] Vila, Leigh. "Riders to the Sea." LitCharts. LitCharts LLC, 23 Aug 2017. Web. 11 Nov 2020.

[8.] Dutta S, (2010)_ Riders to the Sea: A newly genre tragedy. https://www.researchgate.net/publication/294330910_Riders_to_the_Sea_A_New_Genre_of_Tragedy.doi.org%2F10.13140%2FRG.2.1.4028.1363.

[9.] Bruce ,(2016). Maurya as a tragic hero.https://www.enotes.com/homework-help/maurya-from-riders-sea-considered-tragic-hero-why-661968 Accessed 1 September,2020.

[10.] Bachelorandmaster.com. Characterization of Maurya in Riders to the Sea. https://www.bachelorandmaster.com/globaldrama/characterization-of-maurya-in-riders-to-the-sea.html. Accessed on 1 August 2020

[11.] Bruce.Olen (2016),"Is Maurya from Riders to the Sea considered a tragic hero? Why or why not?" eNotes Editorial, 25 Mar. 2016, https://www.enotes.com/homework-help/maurya-from-riders-sea-considered-tragic-hero-why-661968. Accessed 3 Sep. 2020.

[12.] *Slattery, 2012. The tragic character of Jocasta. https://www.bartleby.com/essay/Jocasta-as-a-Tragic-Hero-F37UU3J.*

[13.] eNotes Editorial,(9 Feb. 2017)."What role does superstition play in Riders to the Sea? " https://www.enotes.com/homework-help/what-role-superstition-play-riders-sea-636266. Accessed 24 Sep. 2020.

[14.] Megan,(2015) .Oedipus: The Tragedy of Fate. https://medium.com/world-literature/oedipus-the-tragedy-of-fate-fbb7890d0183.Accessed 1 September,2020.

[15.] UKEssays. (November 2018). Fate In Oedipus The King English Literature Essay. https://www.ukessays.com/essays/english-literature/fate-in-oedipus-the-king-english-literature-essay.php?vref=1.Accessed 1September, 2020.

[16.] Ahmed A, (2015). Role of the Sea in the Play Riders to the Sea. https://www.google.com/url?sa=t&source=web&rct=j&url=https://englishstudyhub.blogspot.com/2015/11/role-of-sea-in-play-riders-to sea.html%3Fm%3D1&ved=2ahUKEwj_h97aiIDsAhW0wjgGHRkIDwMQFjACegQIDxAM&usg=AOvVaw39vU_Y51QIVGyxxYnqEmeD .Accessed 24 september,2020.

[17.] Enam T,(2014).Portrayal of Maurya as a Universal Mother in 'Riders to the Sea' by John Millington Synge https://www.google.com/url?sa=t&source=web&rct=j&url=https://enamsnote.blogspot.com/2014/11/portrayal-of-maurya-as-universal-mother.html%3Fm%3D1&ved=2ahUKEwiX3vLDj4DsAhWczTgGHcbVCB4QFjAAegQIBRAB&usg=AOvVaw0M1chUIGa8_NyhfH3t2e-C . Accessed 24 September,2020.

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Youth Entrepreneurship Development Through Training: An Evaluation of Some Programmes in Bangladesh

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Abstract

The present study is the outcome of the initiative of the Government of Bangladesh to evaluate the Youth Entrepreneurship Development Programme (YEDP) through learning the performance of other similar programmes. The data for the study were collected both from secondary and primary sources. For secondary data, various documents of the Department of Youth Development (DYD) were consulted and for primary data, a multi-stage sampling method was employed. The study revealed that among the respondents, 62 percent belonged to the landless and small farmers' categories and 93 percent belonged to the 18-35 years of age groups which was 65 percent in case of Non Programme Beneficiaries (NPBs). In case of Programme Beneficiaries (PBs), 87% respondents belonged to education group class VIII and above against the corresponding figure being 54 percent for NPBs. Nearly 53 percent respondents received training under Youth Training and Self Employment Programme, 23 percent under Technical Training Programmer and 23 percent under Youth Training Centre against the beneficiaries of 69 percent under NPBs. Among the respondents, only 11 percent received credit from programmes against 73 percent for NPBs. Nearly 56 percent trained youths got employed and invested their own capital for productive enterprises. Most post training employment happened in enterprises like petty business(26%) , service(16%) ,agriculture (14%), poultry rearing (13%), fishery (11%),tailoring (8%), dairy cattle rearing (5%) ,overseas job(2%) and technical job(7%).Respondents' observation on Youth Training and Self Employment revealed that the courses are more lecture oriented and sufficient demonstration sessions on different enterprises at the field level may be arranged by the organization concerned. Regarding Technical Training for Unemployed Youths, it revealed that the scope of computer training should be widened by including basic, internet, hardware, software etc. To help promotion of youth entrepreneurship, best trainers of different courses should get first priorities in conducting technical sessions. The study concluded that a coordination mechanism should be developed to link the three programmes and to develop a functional linkage among different tiers of DYD at upazila, district and YTC level.

Keywords: Youth, Entrepreneurship, Training, Enterprise, Self-employment

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INTRODUCTION

Bangladesh is one of the densely populated countries of the world with more than 1125 people per sq.km and majority of her population, around 70 percent living in the rural areas with agriculture (47.30%) as their main occupation(BER-2020). During the last few decades, Bangladesh economy has undergone rapid structural transformation towards industry and service sectors. As per Bangladesh Economic Review (2020), the share of agriculture to GDP was 12.68 percent, to that of Industrial sector 29.65percent and service sector was 52 .85 percent. The average growth rates (%) of these sectors were recorded at 3. 21, 7.49 and 6.17 respectively .The average growth rates of GDP had shown upward trends from 3.74 percent in 1980-81 to 8.20 percent in 2019-20. The growth of import-export trade, secular increasing trend in the flow of remittance and the favorable balance of payment in the current account kept the external sector to some extent stable (Source: Bangladesh Bank). Thus employment provides the key link between economic growth and poverty making it the major tool for poverty reduction in Bangladesh.

According to United Nations Commission for Trade and Development(UNCTD) , Bangladesh is in a better position because of the policy of trade liberalization pursued by the government. In the SDGs(17 Goals, 169 Targets & 232 indicators), poverty alleviation has been given the highest priority and the government of Bangladesh has implemented 8th Five Year Plan (2020-2024) through undertaking programmes of economic growth, poverty reduction and social development in which development of entrepreneurship through skill training, good quality employment opportunities for youth population etc. have got special priority. Thus, it has been categorically mentioned that during the plan period (FY2020-FY2024), 10.40 million new jobs will be created in the economy for the 18-35 age people with 5.80 million in rural and 4.60 million in urban areas. If the present definition of youth is considered, the total youth force will further increase to higher level in the years to come. From the literature, it is found that these categorized people are treated as youth group who need self as well as wage employment under the initiative of development organizations both at government and non-government levels. The constitution of Bangladesh in its article no 20 mentioned that “work is right, a duty and a matter of honor for every citizen capable of working and every one shall be paid for the work”. Similarly, the article 15 ensures provision of basic necessities, right to work and right to guarantee employment and social security. The article 23 stated “everyone has the right to work, to free choice of employment, to just & favorable conditions of work and protection against non-employment. If youth are defined as those who belonged to the age group 15-30 years, they are nearly one third of the total population. If the age group covers 18-35 years as youth, the figure will be higher than one third of the total population (source: GOB).

The major issues which the policy planners would continue to face in the present century regarding the youth are how to change the attitude of the youths towards work culture, how to innovate new skill for the youth, how to ensure self-employment to the vast number of trained youths. Answering all these questions presupposes a sound organization with holistic national youth policy for development. Youth has been defined as transition period of an individual from child to adulthood. The United Nations has declared population of 15-24 years age group as youth. Different countries have defined youth by different age limits. There are also variations of age limit among some Asian countries such as

Bangladesh (18-35; India (15-34); Pakistan (18-30); Srilanka (15-29); Malaysia (15-29); Nepal (15-40); Singapore (15-30); Hongkong (10-24) etc.(Source:GOB)I

In considering the needs, the Department of Youth Development (DYD) was established in 1981 with the vision of facilitating the unemployed youth with vocational/skill development training for gainful self employment to bring them in the mainstream of national development process. The National Youth Centre (NYC) was established by DYD in 1998 as a Human Entrepreneurship Development Centre to transform the unemployed youth into an organized, disciplined and productive human resource by organizing training, seminars, workshops, symposium, youth summit and youth exchange programmes both at national and international levels. Moreover, the centre conducts research work on youth development issues of national interest.

DYD has been implementing several programmes to achieve the goal of socio-economic development of the youth of this country, and the success of these ongoing programmes will finally determined by the extent of benefit derived by the stakeholders concerned. Besides, because of changing socio-economic scenario, it is quite likely that new problems arise or limitations get in the way of programmer implementation. Such problems and limitations should be identified so that future implementation does not suffer similar problems. DYD has a wide network of activities throughout the country in a diversified way and it is, therefore, deemed necessary to assess effectiveness, efficacies, relevance as well as limitation of all these programmes of the DYD through investigating the strengths and weaknesses of the ongoing programmes. The present study is a modest attempt to evaluate some of the programmes of DYD out of the researcher's pursuits in the field of development.

There are a few studies available at the disposal of the researchers on entrepreneurship.. According to Hedge (1960:21), there are established network of youth club in UK .These are the National Sunday School Union, National Association of Mixed Clubs & Girls Clubs. Hagigi & Lin (2012) in a study found that the variables that affect the motivation for entrepreneurship development in Bangladesh include I) the degree to which the compensation of the decision making is tied to the success of the decision; (2) the investment time-horizon;(3) the experience; and finally (4) the degree to which the decision maker shares the decision with others or whether the responsibility is borne solely by the decision maker. By stimulating its entrepreneurship development, Bangladesh can take advantage of its population & geography to experience greater economic growth. Ali, Easin, et.al (2006) in another a study on An Assessment of the Effectiveness of the Ongoing Programmers of DYD revealed that the self employed respondents have created additional employment within and outside their families. Moreover, most of the educated trained youths have changed their attitude to-wards self-employment rather than wage employment. Some of the respondents opined that they faced social problems since self-employments were not commensurate with their family status in the community. The study recommended that an umbrella coordination mechanism would be required to link programmers and to develop a functional linkage among the different tiers of the programmer implementation. Hytti & Gorman (2004) argued that the entrepreneurial skills of the general people are now considered as a competitive advantage of a native over others.National competitive advantage is increasingly dependent on the skill base of the workforce, and more specifically, on the ability of both firms & individuals to engage in innovative activity & in new economic activity.

The studies so far reviewed on the issue do not give any conclusive evidence on the involvement of training on the development of entrepreneurship. However, the proposed study helped to minimize some of the knowledge gap and paved the way for further research in this line.

I. Objectives of the Study

The general objective of the study is to critically assess the effectiveness, efficacy and relevance of the ongoing DYD programmes in respect of fulfilling the set target

The specific objectives of the study are as follows:

a) To assess and determine the types (size, extent, and coverage) of three ongoing programmes of Department of Youth Development (DYD);

b) To ascertain the contribution of DYD programmes towards socio-economic development of the beneficiaries households as well as the country;

c) To evaluate critically the performance of these programmes individually and identify the possible the loopholes;

d) To recommend ways and means to improve the efficiency, efficacy and effectiveness of the DYD programmes ;

II. SCOPE OF THE STUDY

The study addressed the following project/programme based variables that constituted the scope of the study:

Sl. No	Programme	Variables/Issues
1.	Youth Training and Self-Employment Project	Biographic Information of trained youths under this programme, permanent address, demographic composition of the family, educational status, occupation, asset ownership, etc. Skill development training i.e. training policy, areas of training for self-employment schemes, effectiveness of training, linking training with credit, training credit linkage, sustainability of self-employment programme through training credit linkage, mobile training aspects, self-employed youth as successful entrepreneur, training credit linkage as engine of change agent.
2.	Technical Training Project for Unemployed Youth (Phase - 11)	Biographic Information of the trained youths under this programme; social awareness, attitude, knowledge building programme, attitude towards self-employment, skill training of different trades, e.g. computer, electronics, house wiring, refrigeration and air-conditioning etc. as agent of self as well as wage employment; policies, programme. arrangement, infrastructure facilities, aids etc.; quality of skill training, linking training with self-entrepreneur i.e. present status, success as entrepreneur, economic development, owner of small and medium scale workshop; Linking training with job, employment market both in and outside the country, present status-both economic and social.`
3.	Youth Training Centre Project	Biographic Information of trained youth of YTC. training for self-employment e.g. livestock, poultry & pisciculture, etc., linking inputs with training arrangement, quality of inputs, cost of inputs, linking credit with inputs, cost of inputs and its effectiveness in profitability, peak and lean period and its effects on the youth .

Materials and Methods

The approach of the study is to satisfy the inner view of the organization by the judicious use of both qualitative and quantitative date on the issue. Accordingly, a detailed method of the study research has been framed considering the specific objectives, scope and design of the study.

Data Source*:* The data for the study were collected from both secondary and primary sources in consultation with NYC, DYD.

Secondary*:* To fulfill the objectives of the study, secondary data were collected by way of consulting various documents of DYD i.e. National Youth Day\- 2004 and book- lets periodicals & son on. Furthermore, various govt. reports like Statistical Year Book of Bangladesh (SYB), Planning Commission Report etc, were consulted, besides, for a comparison, secondary data on similar programmes of Department of Women Affairs (DWA), Department of Social Services (DSS) and Bangladesh Rural Development Board (BRDB) were collected through consulting relevant literature.

Primary*:* For critically evaluating the individual performance of the programmes of DYD, a carefully designed sample survey had been employed in the study, Moreover; some methods like Case Study, Focus Group Discussions, Informal Interview, Observation, etc. were employed. DYD's programme beneficiaries as well as field officials were also interviewed for the purpose of the study.

Sample Design:

As per the document of the DYD "National Youth Day", there are eight projects/programmes that were implemented/completed by the DYD. Accordingly, four projects/ programmes such as (I) completed Youth Training and Self-Employment Project; (ii) Technical Training Project for Unemployed Youths) Phase-II), (iii) Youth Training Centre Project and (iv) Family Based Employment Programme (Poverty Reduction Programme) were primarily selected for the proposed study work. Accordingly, considering time and other logistic support services, three programmes such as (I) completed Youth Training and Self-employment Project, (ii) Technical Training Project for Unemployed Youth (Phase ii), & (iii) Youth Training Centre were taken under this study for achieving the desired goal.

Selection of the study area*:* In selecting the study area, a multi-stage sampling approach beginning from administrative divisions down to the clients in the project/ programme areas was used. The study covers 13 Upazilas of 13 districts under six administrative divisions. Those 13 districts include four divisional head quarters level districts and 9 other districts-one from each division. In selecting the districts other than divisional headquarters level districts, availability of most DYD programmes were taken into consideration. In other words, only those districts which have most programmes of DYD were selected. Again in case of Divisional headquarters level districts, all trades under DYD were covered. For the divisional district headquarters, the Sadar Upazila/thana and for other districts, any Upazila having most DYD interventions were selected. As a result, 13 Upazilas/thanas were covered under this study. Two Upazilas of each division were selected except Dhaka division where three Upazilas were covered under the study. The sample study areas are as follows:

Sl. No.	Name of Upazila	Districts	Administrative Division
01.	Sonargoan	Narayangonj	Dhaka
02.	Bhaluka	Mymensingh	Dhaka
03.	Rajoir	Madaripur	Dhaka
04.	Bashkhali	Chittagong	Chittagong
05.	Teknaf	Cox's Bazar	Chittagong
06.	Sylhet Sader	Sylhet	Sylhet
07.	Rajnager	Moulavibazar	Sylhet
08.	Boalia Thana Unit	Rajshahi	Rajshahi
09.	Birol	Dinajpur	Rajshahi
10.	Mullahat	Bagerhat	Khulna
11.	Meherpur Sadar	Meherpur	Khulna
12.	Babugonj	Barisal	Barisal
13.	Pirojpur Sadar	Piojpur	Barisal

Selection of the Respondents*:* There is a paucity of information on the number of total beneficiaries of the programmes in 13 selected Upazilas. However, it is estimated that these 13 Upazilas have total of 27.000 (Twenty seven thousand) beneficiaries during the study period on different trades/aspects. It means that around 2000 beneficiaries received training under three programmes of DYD in each Upazila during the study period .As per record, it was found that a total of 17390, (15257+1041) beneficiaries received training on different trades within the study period under three projects of DYD, However, for the sake of batter representation and accuracy in sample selection while determining the final sample size, the following statistical formula had been used for each programme (Kothari, 2004).

$$n = \frac{z^2 . p^- . q^- . N}{e^2 (N-1) + Z^2 . p^- . q^-}$$

Where n = the sample size

N = The total population

p^- = The Sample proportion

p^- = 1- p^- =0.5

Z = The value of the standard variant at a given confidence level.

The total sample size for each project was determined by using the statistical formula in consultation with NYC, DYD. Care was taken in determining the represent able sample size so that all the trades were proportionately selected separately in each Upazila for each project on the basis of statistically selected total sample size. The selected sample sizes for the study were 650. 287 and 291 against the statistically required sample size 633, 285 and 281 under the projects of Youth Training & Self-employment, Technical Training for Unemployed Youth and Youth Training Centre respectively. A total of 1228 trained youths under the three projects were listed for the study, the investigator could cover 1110 (90%), the rest 118 (10% were not available for interview. Some of them were not present, some of them were in service and some of the were not staying their address. Etc. Out of the interviewed responds (1110) 402 (36%) were female. On the other hand, in order to draw a comparative picture. 301 respondents were selected as NPBs under DWA, DSS and BRDB form the selected Upazilas//Thana.

Instruments for Data Collection: Three sets of interview schedule/Questionnaire-one the organization profiles/active, one or the beneficiaries of the programmes, and one for

the DYD officials were administered for the study. The schedule for the organization's profile included genesis, vision, goal, objective, organization structure, large groups. self-employed youths, particularly trained youths on different trades .The schedule devoted to the beneficiaries included biographic information, forms of assets, utilization of training and credit, benefits derived, problems encountered, suggestion for future improvement etc.

. All necessary support services were provided to the data collectors fro the research project. Data were collected over a period of 3 months and FGDs were organized simultaneously at the divisional headquarters. These activities were followed by data processing, and field checking for validation of data within this period.

Data processing and analysis*:* After completing field work and receiving all schedules in hand, efforts were made to process and analyze data. It was neither possible nor desirable to convert all qualitative data into quantitative form to support analysis of facts. The researchers' observations and impressions were helpful for gaining a true picture of the study area as well as the study samples.

Informal Interview*:* Informal interviews were conducted to gather some basic information through gossiping, exchange of views etc.

FGD**:** This was employed to gather qualitative information from the respondents. The researchers discussed the variables and collected the view of the respondents.

Observation*:* The researchers followed this method in order to further gain ideas of development through interaction with beneficiaries and observing their IGAs and living conditions.

III. RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of the Respondents:

Population: Total number of population of the 1110 and 301 Households (HHs) was 6356 and 1537 respectively. An average HH size was found to be around 5.73 and 5.10 respectively for programme and non-programme beneficiaries which was almost similar to the national average size being 5.4 (Source: Bangladesh Bureau of Statistics)

Land Ownership*:* Land holding plays a significant role in determining the social status of the family. It was found that about 15% (170) respondents had their own land. The HHs belonged to the different categories of land ownership e.g. landless (48%), small (35%), and medium and above (17%). It was found that 83% of the stakeholders belonged to the landless & small farmer's categories which indicated that the DYD authority has been able to address the target group of youths from disadvantaged households which was one of the objectives of the programmes. Land holding patterns of NPBs were almost same as DYD beneficiaries.

Age Structure: Age is important factor for pro-active youths. The people who belong to the age group 18-35 years are defined as youth in Bangladesh. Among the respondent (1110), 1023 (92%) belonged to the 18-35 years age group while it was only 65% for NPBs. It is evident that the DYD rightly selected the target youth group for self-employment training. Out of the interviewed respondent (1110), 708 (64%) were male.

Marital Status*:* It was found that about 39% and 47% beneficiaries were married before and after joining the programme of DYD and in case of NPBs, the present marital status was 87%. It also indicates that in the selection procedure, the unmarried youth got preference.

Educational Status: Regarding education, it was found that 31% of the beneficiaries belonged to the level of SSC followed by 25% in the level of VIII-X, 20% in the level

of HSC, 13% UP to VII, 11% in the level of bachelor & above. The educational status of the beneficiaries reveals that about 87% beneficiaries belonged to the education level of VIII and above which indicated the right selected of unemployment youths form among education people for their self-employment in the study areas. In case of NPBs, this was 54% only and the rest 40% & 6% were up to VII grade and illiterate respectively.

Service Received: It was found that out of 1228 stakeholders, 650 (63%) received training on different trades under Youth Training and Self-employment programme which are categorized as institutional (153) and non-institutional (Mobile) (497), followed by 287 (23%) and 291 (24%) under Technical Training for Unemployed Youth Programme and Youth Training Centre respectively. It was observed that training courses on about 12 categorizes of trades, 5 technical categories and one capsule training course were organized under the Youth Training and Self-employment, Technical Training for Unemployment Youth and Youth Centre Project of DYD respectively. Regarding the extent of coverage under the three different project, it was learnt that the gap between numbers of rural and urban trainees was found narrow in cases of Youth Training and Self-employment Project (on an average, 1041 for rural Upazilas and 1473 Sadar Upazilas respectively). However, the gap was very wide for the other two projects. Incase of Technical Training Project, the number of participants was 216 for Sadar Upazilas against 25 rural Upazila on an average while in case of YTC, the number was 140 for Sadar Upazilas and 53 for rural Upazilas. When asked about who had motivated the trained youth to attend training courses of DYD, the respondents gave mixed responses. It was learnt that the majority (34%) were motivated by YDOs and other Upazila level officials of DYD followed by self-employed trained youth (27%) and relatives/friends (15%). The other factors were district level officials (12%) and self-initiative (8%) while CDOs' role was learnt to be the least (3%)

Respondents Assessment of Quality of Training:

The overall satisfaction of the youth respondents about the quality of training they had received from DYD was estimated to be 55%. However, the programme-wise performance shows that the Technical Training for Unemployment rendered the highest level of satisfaction (69%) to the trainees followed by YTC (54%) while the satisfaction level in case of Youth Training & Self-employment was learnt to be the lowest (48%) among the three programmes. The finding underscore the necessity for taking measures for further improvement of all the programme since the satisfaction level remains at the medium level and special thrust for improvement of quality would be needed in case of Youth Training Self-employment.

Standard of Mobile Training: The composite index (CI) of the standard of mobile training indicates that the trainees of DYD training as a whole obtained moderate satisfaction. The overall satisfaction was 49%. The level of satisfaction about the standard of mobile training remained within the range 48-50. The lowest satisfaction was learnt in cases of Rajshahi and the highest in case of both Dhaka and Khulna. The finding lead to conclude that there is ample scope to improve the quality of this training.

Respondents' Vies about Quality of Trainees: The trained youth under DYD were asked to assess the standard of theoretical and practical knowledge and skill the trainers of the three different training packages. Among the 1110 trained youth, 713 (around 64%) gave their opinions and the remaining 397 (36%) made no responses in this regard. According to majority of the respondents, the trainers' theoretical and practical knowledge was moderately good

(44% and 46% respectively).This was followed by the score good (43% and 40% for theoretical and practical knowledge respectively).While 13% of the respondents evaluated the standard as very good for both theoretical and practical knowledge, only 4% (quite insignificant) and said that the standard of the trainers was not satisfactory. The trainers' theoretical and practical knowledge was learnt to be moderately good according to most respondent (44% and 46% respondent) followed by good (43% and 40%). In the Composite Index measurement, overall satisfaction about the standard of theoretical and practical knowledge gained through DYD training was 56% and 55% respectively. The self-employment training suffered the lowed score (51% and 49%).The finding regarding the trainers' quality of theoretical and practical knowledge and skill indicate that TOT and advanced training would be needed for the trainers to upgrade their training performance.

Utilization of Training in Employment Creation:

The study reveals that a remarkable improvement has happened in the employment situation as a result of DYD interventions of training and credit. In the pre-intervention period, the employment rate was only 249 (22%) among the respondent youth. But the figure has shot up to 628 (66%) (for trained youth). They have got involved in different trades occupation. The actual number of respondents who utilized training in the respective fields was 581 in self-employment and 43 in the trade oriented jobs. As a result, the percentage of utilization of training in the respective field was 56.Most employment happened in petty business (26%) which was followed by service (16%), agriculture (14%), poultry (13%),. fishery (11%), dress making (8%), dairy/cattle rearing (5%), and overseas job (20%). The technical jobs combined generated 7% of total employment. Among the technical jobs, 45% were in computer, 21% were in electrical works and 10% were as mechanic. The remaining 24% were as driver, carpenter, mason and veterinary/herbal doctor. The region-wise scenario of involvement in different occupations (DYD) training based occupations and other occupations combined) reveals a relatively poor achievement in Rajshahi and Sylhet compared to Dhaka. Chittagong, Khulna and Barisal. In Rajshahi and Sylhet, 67% and 76% respectively have been reported to be employed in different IGAs. Whereas in Dhaka, Chittagong, Khulna and Barisal, the Corresponding rate were learnt to be 85%, 89%, 82% and 81% respectively. However, in case of self-employment creation and employment in other jobs based on DYD training, Khulna, Chittagong, Dhaka and Barisal show a better performance (83%, 64%, 60% and 58% respectively of trained youth) compared to Rajshahi and Sylhet (34% and 43% respectively). The programme-wise utilization of training indicates that, the utilization of training in employment generation was highest in case YTSE (65%) and lowest in case of TTUY (43%).

Sources of Capital:

Among the actual respondents (1110), only 118 said that they had received credit form DYD. It means that only around 11% received credit while 89% of the trained youth received no credit from DYD during the said period. Again, out of 118 recipients of credit, 91(77%) received credit once and they received Tk. 29,165 on average. On the other hand, 27 youth received credit twice and on an average, they received Tk. 48,925 in two terms. DYD credit support has been learnt to concentrate among the beneficiaries of Youth Training and Self-employment Programme followed by beneficiaries of YTC training. Among the 118 credit recipients, 58% are from the youth training and self employment

programme and 36% are from YTC training. The rest 6% are from among those who received Technical Training. The relatively small number of borrowers under Technical Training may be due to greater involvement of technically skilled youth in wage employment. Regarding amounts of credit received, it is evident that the highest number (34%) among the recipients received credit within the range Tk. 20,001-30,000 followed by 32% within the range Tk. up to 10,000 and 29% within range 10,001-20,000. Only 05(5%) received credit between Tk. 30,001-50,000. Sources of capital were of three types: I) only credit, ii) only own capital, iii) credit + own capital. Among those who got employed in various IGAs, 4% depended on credit only while 16% added own capital to credit. On the other hand, 80% received on credit and invested their own money. Among the trained youth, only 54 (5%) received credit form other sources. Such borrowers are mostly from Dhaka (42%) and Chittagong (30%). Non was found having received credit from other sources in Sylhet. It was also observed that, while 14% (11% from DYD + 5% from other sources) among the DYD trained youth received credit support, 73% received credit support form various sources in case of NPBs. Again, in case of borrowers from other sources, 40(74%) took credit from NGOs, 11(20%) from Banks and rest 3(6%) from BRDB.

Cost of Trained Youth in Receiving Credit from DYD and Other NBDS:

The respondents expressed that they incurred incidental expenses in connection with receiving credit form DYD and NBDs. The expenditure heads were TA/DA, photocopy, project preparation, judicial stamp, office expenses etc. It was observed that the expenses were more visible or dominating in most heads in case of DYD credit than in case of NBDs. As it shows, the cost receiving credit was higher for DYD borrowers than NPB borrowers in cases of four heads out of six heads. DYD borrowers spent less than NBP borrowers only under two heads; overall, 98 taka was spent by DYD borrowers on an average against 68 taka spent by NPB borrowers on an average. It was found that 22% (249%) of the respondents out of 1110 were involved in employment before receiving training while it was 66% (728%) after receiving training from DYD. It was further learnt that a total of 581 (52%) got self-employed in DYD trained trades and 43(4%) became employed in technical jobs. In case of income, 879(79%) were found to be earning income through different occupation. The figure, however, excludes students and unemployed persons (31). Among the employed youth under DYD programmes, 78% belong to the monthly income range Tk. 501-6000 and the remaining 22% earned more than Tk. 6000. The majority (31%) belong to the income range of 2001-4000 followed by 26% in the income range up to Tk. 2000 and 21% in the income range 4001-6000. Among the respondents, 6% earned more than Tk. 10,000 on an average.

Employment Generation by the Trained Youth:

As the findings show, the trained youth created self-employment no only for themselves, but also for additional persons within and outside their families. The self-employment is 581 in number. They created additional employment of 464 persons of whom 335 (72%) are family members and 129 (28%) are hired persons from outside. Again, the full time and part time employment are 63% and 37% respectively. On the other hand, 60% among the employed are male and the remaining 40% are female. On an average, the self employed youth created 0.80 additional employment for others. It means that DYD training had also positive impact on employment creation beyond its target group. It indicates that the trained youth are contributing to their family as well as to the country regarding employment generation.

Monthly/Annual Income of the Respondent & HHs:

It was found that in case of income of the respondents in post training period, 879 (79%) were involved in earning income more than Tk. 500 while it was only 473 (43%) persons in the pre training period. The average annual income of the respondents increased from Tk. 14,808 to Tk. 43,980. The indicates that income of the respondents increased significantly with the change of occupation after training under DYD Programmes. It was found that 43% (478) HHs earned monthly income equal to Tk. 5001.00 and above before joining the DYD programme while it reached to 59% (652) after joining the programme. It was also found that the monthly average income of the surveyed HHs. increased from Tk. 5688.00 to Tk. 7063.00 over the years. The per capita income also increased from Tk. 12,365 to Tk. 14,796 over the years. Besides it was also found that the contribution of the respondents' income to the total income of the family increased significantly. About 499 (45%) respondents had no contribution to their families' income before joining the DYD progarmme while the number decreased to 231 (21%) over the three years or less than three years. It also indicates that over the years the contribution of employed respondents' income to the family increased significantly with the range of 10% to 90% which was a remarkable achievement of the employed Youths. It was also learnt from the composite index according to the respondents that, the positive significance of contribution of DYD changes in their socio-economic conditions is 53% as against 29% of the other organizations.

Social Development:

Social status generally depends on the economic solvency as well as earning capacity of an employed person. The self-employed youth benefited in several ways. It was found that 73 percent trained youth expressed that their status had increased in their family as well as in their community. The employed and self-employed persons, particularly the persons form the disadvantage families are earning money which are directly contributing to raise the standard of living of their families. It indicates that the trained youths have engaged themselves in productive sectors (like poultry, livestock, garments and dress making to earn income for themselves as well as for the community. It was observed that 86% of respondents had positive impact on their families as well as on community and 15 percent respondents had less or negative impact on the family. It was found that in case of certain occupations, the self-employed persons from a rich family were not acceptable to their family, particularly in the occupation of poultry & livestock rearing. As result, some of them are now searching for other occupations or have switched over to other occupations. The have facing social problems also. Generally, in rural areas, social acceptability or status is measured by some indicators, such as land ownership, honour and respect shown by people, While asked about the befit gained through this programme, most of respondents, i.e. 946 (85%) remarked that they had benefited fro DYD's training and credit support. They specifically mentioned that they had benefited form this programme through participation in development activities (86%), increased participation in decision making, (86%) increased own capital (86%), free movement (76%), increased cooperation of male counterpart (44%) and right established on the family assets.

Maternal and Child Care *:* A total of 46 and 65 cases of child delivery took place during the last three years (collected) through recall method) from the 1110 sample HHs of DYD and 301 HHS of NPBs respectively. Out of them 68 (314) and 78 (49) per cent deliveries occurred at home and the rest occurred in the clinic or hospital. In cases of Child and maternal mortality due to pre and post delivery

complications within one month of delivery during the last 3 years, it was found that 9 (20 per thousand) infants died within one moth of delivery and 12 (26 per thousand) died within one year of birth and 01 (2.16 per thousand) mother died due to delivery related complication. The death rate of mothers per thousand child births was 2.16 as compared to the national figure being 3.2(Bangladesh Economics Survey(2020).
Infant mortality rate per thousand live births was 26 as compared to the national average 54.0 (ESCAP) , So it is evident that pre and postnatal care services have increased in the surveyed HHs due to awareness raising and other indirect impact to the DYD programmes.

Preventive Services: It was observed that the vaccination of Children against six killer diseases and vaccination/injection (TT) of pregnant mothers and child bearing age women was completed and family planning was adopted by the respondents' HHs through motivation of DYD and other NBDs. The respondents expressed that children and child bearing mothers belonging to their HHs were fully covered by vaccination. Respondents were fully aware abut family planning also. It was fund that EPL and TT coverage (full doses) was found 100%.So it is evident that the surveyed HHs were highly aware about the health services.

Water & Sanitation*:* With a view to preventing water borne diseases, safe water and hygienic latrine played a vital role. Out of 1110 households, 960 HHs (86%) were using safe drinking water against the corresponding national figure 79% (SFYP, p. 24). About arsenic test, it was found that only 133(12%) HHs examined/tested their tube-well water.
On the other hand, it was also found that out of 1110, 970(87%) HHs were using hygienic latrines which was also higher as compared to the national average (85%) (SFYP, p.24). These findings may indicate the positive impact of the DYD programmes as well as other NBDs programmes on the surveyed HHs. Overall, the survey reveals that due to the intervention of the DYD programmes as well as other NBDs/NGOs, a positive change has occurred in the surveyed HHs in using safe water and hygienic latrines.

Gender Development*:* It was found from the study that, 402(36%), out of the selected respondents were female. The female respondents opined that after getting training and other inputs, they were involved in income generating activities resulting in their increased acceptability in the family. On the other hand, the respondents expressed that their involvement in development activities and different programmes of GOs had highly increased. Their mobility as well as their participation in all sectors had also increased. As a result, their employment was also raised. On the other hand, the policy of DYD also ensures greater involvement or women through compulsory participation of 33% women in all its development programmes. The areas where the involvement or improvement of female respondents occurred during the last three years are: involvement of women in IGAs (75), increase status (75), increased mobility (74), increased participation in development activities (90), increased participation in decision making process (71) and increased own saving (89). This, in the long run, would help to reduce gender disparity and promote gender balanced development.

Education of Children in Surveyed HHS*:*
In order to learn about the schooling of children of the respondent families, the respondents were asked how many within the age range of 6-14 years go to school and how many do not. It was learnt that out of 902 children within this range. 887 (98.34%) go to school and the ret 15(1.66%) do not go to school. The reasons expressed are poverty (6), reluctance of children (2), still too young (as per opinion of the guardian) to go

to school (6) and lack of awareness (1) However, the overall school going scenario among the school age children of the respondent families has been found highly satisfactory. In case of NPBs out of 279, 13 (5%) children do not go to school due to poverty.

Social Awareness Raising through DYD Training Programmes: Raising the consciousness level environment, health, family planning, sanitation , nutrition, human rights, HIV-AIDs, leadership, youth activities, dowry, consequences of drug addiction, good behaviour and other aspects of social life is an integral part of the institution based training courses of DYD except mobile or non-institutional training courses. Out of total surveyed HHS (1110), 141, 266 and 256 respondents received institution based training under Youth Training and Self- Employment, Technical Training and Youth Training Centre Project respectively. Out of total 663 respondents, most expressed their awareness and positive views about the topics incorporated in the training courses. They said that they had learnt about these issues in the training courses of DYD may be consulted for detailed information.

LEARNINGS FROM FGDs

Focus Group Discussions (FGDs) were organized in Boalia, Rajshahi and Teknaf, Cox's Bazar, Both youth stakeholders and DYD Upazila level officials participated in the FGDs. The youth respondents comprised both male and female stakeholders from among those who had received training from DYD. While selecting youth for FGDs, care was taken in order that they represent most trades covered under DYD training.

Youth Stakeholders' Opinions: The utilization and impact of the training programmes as well as credit support of DYD were reviewed in the FDGs. The participants expressed their opinions about the quality of the training and credit services, and also suggested some measures for their improvement. Certain new areas of future training also came up during the discussion, which according to the participants, could be considered for serving specific needs of their respective localities. Details follow:

Mobile Training:

(1) The youth, specially women, are quite positive about the necessity of mobile training, They consider the duration of different mobile courses enough for raising awareness and gaining initial knowledge about the subjects. However, they fell that they cannot precede much on the basis of knowledge gained from these courses. The practical side of the training is not sufficient, they opine.

(2) The mobile courses are mostly lecture oriented. They suggest that for courses such as fish culture, cattle fattening and goat rearing, there should be an addition of 3-7 days exclusively for intensive practical training while the duration of sewing and dress making courses should be extended to 2-3 months since learning these skills needs more time and practice.

(3) Regarding duration of the training courses, an alternative suggestion has also come up. Even without changing the present durations of these courses, the inadequacy can be compensated by organizing advanced courses at the Upazila/district level for those who are interested in further learning.

Institutional and Technical Training:

(1) The respondents recognize the usefulness of all the courses under institutional training. They however, express some reservation about stenography which is a component of the secretarial science. Although

stenographers have limited demand in the current job market, computer is a highly demanding subject, and it is essential for secretarial jobs now-a days. In fact, both stenography and secretarial science are job oriented skills rather than self-employment oriented. Therefore, considering the need of the job market, computer should also be included in the secretarial science course as a package progarmme.

(2) Dress making has bright prospect for both self-employment and wage employment. It has demand in garments sector and technical colleges. Considering the current need and wider scope of the subject, the duration should be extended to six months. Besides, the module should be redesigned incorporating the current market needs. male youth should also be included in this training.

(3) The block-batik training has high potentials for self-employment. It should be development as a six-month course and post training self-employment should be supported by DYD through opening show-rooms of products of trained youth at popular market centers.

(4) The existing one-month duration of the fish culture training is not enough. The participants suggest an addition of minimum one month's practical training as well as introduction of kit box to make the training effective. DYD should also develop linkage of trained youth with concerned service providers and hatcheries to facilitate easy access to fish fry, fingerling s and other necessary inputs and services.

YTC Training:

(1) The package training of cattle nearing, poultry rearing and fish culture organized at YTC is mainly a theoretical one. The respondents feel that the practical part needs to be strengthened. In order to make this package effective, it should combine tow modules: general training and subject based training. All the participants will attend general module at the start, and later attend subject-specific courses as per their need for separate specific periods. The subject-specific courses will be mostly practical oriented.

(2) The YTC should develop practical training facilities for all the three components of the package. They should also develop partnership with govt. and private agencies to utilize their facilities for practical and demonstration purposes.

(3) The youth respondents and YTC trainers opine that the three-month course duration is virtually less than three months so far working days are concerned. For effective training, the duration could be extended to four months, they opine.

New Training Areas Identified:

(1) They youth in Rajshahi opined that silk and vegetable day have high demand in this region. DYD therefore, could arrange training on silk production and vegetable dye making. One the other hand, they youth attending FGD at Teknaf expressed their need for training on salt cultivation, saline water fish cultivation and afforestation considering the coastal and hilly nature of the region.

(2) The women participants of Teknaf also expressed their interest in training on vegetable dye making. The bock-batik training should be introduced at the Upazila level, they suggested.

(3) The male participants at both areas expressed that dress making

training should also be introduced for make youth. The participants at Teknaf mentioned carpentry, computer, electrical and refrigeration as potential subjects to be considered for their area.

(4) Since Teknaf is a tourists' zone and Cox's Bazar and St. Martin' are neighbouring places of tourism, local handicrafts could be promoted through appropriate training by DYD, they added.

Credit Support:

(1) According to the youth participants, credit amount should vary depending on the types of trades. In many cases, credit allocated is far less than the credit requirement. The ceiling should be raised to Tk. one laky, they suggested. Credit coverage should also be increased so that greater number of youth can avail credit support form DYD.

(2) The existing provision for submitting land records as collateral is often difficult for youth to fulfill since youth usually do not own land during their parents' lifetime.

(3) The youth consider the existing credit delivery system a very slow tedious process. They opined that the whole procedure should be simplified so that they can receive credit shortly after training. Loan approval authority should be decentralized from District to Upazila level for expediting credit distribution.

(4) There should be a provision for rescheduling loan repayment to cope with disaster. In extreme cases of the effects of disaster, the borrowers should be exempted from repayment. The respondents of Teknaf gave these opinions.

(5) The loan repayment schedule should vary on the basis of types of trades. For example, it takes almost o6 months for fish culture and poultry rearing to start giving production. In that case, it is difficult to follow the exiting 4-month based installment schedule.

Coordination: An effective mechanism should be put in place so that the three categories of training can be organized in a coordinated way and YTC, District level DYD and Upazila level DYD enjoy a greater functional linkage and remain well-informed about one another's activities. To this end. some measures have been suggested, specially by DYD officials who attended the FGDs:

1. The YTC Should send its list of trainees to Upazila DYD office on a monthly basis. DYD district office should also send lists of trained youth to Upazilas.
2. Training could be made more effective if YDO remained involved in the selection of trainees from her/his Upazila for YTC training.
3. The YTC trainers should also be involved in mobile training.
4. Youth trained through mobile training should get priority in district level training of DYD.
5. A uniform format should be introduced for selection of trainees.
6. TOT for trainers of DYD at YTC, Upazila and district levels should be organized to enhance trainer's capacity.
7. YDO should be involved in following up the utilization of training by YTC trained youth in his/her Upazila.
8. Deputy Director, DYD should be made the focal point of all activities at different levels (district, Upazila, YTC)

Opinions of DYD Officials:

A Survey was conducted to derive opinions of DYD officials (both District and Upazila level officials) by administering separate questionnaire for them. They made an assessment of the impact of DYD's ongoing programmes on the youth and suggested various measures to strengthen youth activities under DYD. Their opinions are as follows:

Programme Impact:

(1) According to the DYD officials, training courses on various trades have been positively contributing to employment generation for the unemployed youth. Increasing number of youth are getting involved in self employment and gaining economic solvency for themselves and their families. All the respondents except one ranked the impact of training as 'good'. Only one said, the training was 'satisfactory'.

(2) The trained youth are also contributing to social development through their increased awareness of issues such as the curse of dowry, child marriage prevention, AIDs prevention, tree plantation, gender etc.

(3) Through economic empowerment, they are gaining enhanced social status and are also sharing their knowledge and skill with neighbor youth.

(4) On one hand, they are getting rid of the curse of unemployment; on the other hand, they are keeping themselves aloof from unsocial and unethical activities because of their increased involvement in meaningful activities. Already many trained youth have been earning an average monthly income within the range Tk. 10,000-50,000.

***Suggestions for Improvement**:*

Sl. No.	Opinions
1.	The existing manpower of DYD at Upazila level is not enough compared to the present volume of training and credit operations. Therefore, increased manpower would be needed for effectively organizing and imparting training, strengthening accounts and records keeping as well as monitoring, supervision and motivation.
2.	A uniform credit manual to be introduced for all Upazilas.
3.	DD should be the co-coordinating & focal point and principal controlling authority for all filed level activities. This would enhance the capacity of field administration and ensure effective monitoring and supervision.
4.	Field functionaries of DYD should be supported by logistics including vehicle to carry out intensive monitoring and supervision. Land phone as well as mobile phone for Upazila office would be needed for upward and downward delivery of instructions and feedback. This would enhance work dynamism and help field level supervision as well.

5.	Computer facilities to be introduced at Zila and Upazila level DYD offices along with internet connection. It was specially mentioned that record keeping of training and credit needs to be computerized to enhance the effectiveness of DYD's programmes at the grassroots level.

Measures Suggested for Strengthening Youth Training and Self-employment Project:

Sl. No.	Suggested Measure
1.	The training fund, specially mobile training fund to be increased. At the same time, credit fund also needs to be increased to support increased involvement of trained youth in LGAs.
2.	TA/DA for filed visits by DYD officials/CSs to be enhanced, at least twice the present amount. This will enhance field involvement of officials in monitoring and supervision. Besides, credit supervisors should be supported by motor cycles.
3.	Computer training for youth should be introduction at the Upazila level under this project. This would further enhance the effectiveness of the project.
4.	Quality training materials including kit box for primary health care of poultry, livestock would be needed. At least five trainees form each batch to be provided. with kit boxes. All necessary logistic for training should be ensured.
5.	Practical sessions in mobile training should be increased. At the same time, syllabus of all courses needs to be updated.

Suggested Measures for Technical Training Courses:

Sl. No.	Suggested Measure
1.	Technical training courses should residential since they are mostly practical oriented, and commuting every form remote Upazila is difficult and costly.
2.	Training budget should be substantially increased to ensure quality of training.
3.	Learning assessment should be incorporated through provision of examination/post courses assessment of trainees.
4.	Trained youth should receive credit demand basis to ensure utilization of training.
5.	Upazila quota of trainees should be increased for district level training, specially for computer training.

Measures Suggested for Strengthening VTC Training:

Sl. No.	Suggested Measure
1.	YTC training package should included topics such as leadership development, entrepreneurships development, collective business, social values, discipline, behaviour etc.
2.	Training budget should be enhance and daily allowance of Tk.50-60 should be introduced for encouraging youth participation in the training.
3.	Compulsory introduction of filed visits would be needed for practical learning.
4.	A manual on farm management to be develop and distributed among the trainees.
5.	Certain post training support would be very helpful for trained youth. For example, linkage of trained youth with medicine/vaccine suppliers/companies should be established by YTC/DYD. YTC can also produce chicks and supply them among trained youth.

Comparative Analysis of DYD, BRDB, DSS and DWA

The comparative performance of four govt. organizations reveals that DYD is far advanced in respect of training (both mobile and institutional) for the youth as compared to other three organizations i.e. BRDB, DSS and DWA. Three organizations other than DYD also provide training to their beneficiaries at group level and in some cases in their local regional level of institutional training arrangements. In institutional training, some recognitions are made by the DYD to their clients through certificates and training allowances which are not generally available in the group level informal training. In many cases, DYD training claims to be an improvement upon other training of other organizations, specially institutional training in consideration of curriculum, class room arrangement and trainers quality used for this purpose. Linking of training with credit is an important aspect of DYD training programme, and in most cases, though not sufficient, loans are provided to trained youth raining from Tk. 5000-25000 initially depending on the nature and category of borrowers. The repayment schedule and interest rates are also friendly to the borrowers. On the contrary, DSS provides loan in the name of micro credit with differential limits and service charges. The income earned form the credit investment is kept aloof for the group, not the sponsoring

authority. The service charges are also modest and their nature of financing is quite different from other three govt. organizations. In case of BRDB, as largest public sector organization, the training arrangement are confined to Upazila level UCCA and regional based institutional training arrangements concentrated in Sylhet, Noakhali, Tangail, (specially for women) with strong training support form both govt. and donors. The impact of training varies though in most cases follow up of training in some way or other so significant. In spite of that, the DYD training clientele are easily visible because of the involvement of youth in different self-employment projects like poultry, fisheries dairy, and workshops for repairing electronic goods etc. The operational modalities, credit structure, repayment schedule, interest/service charge structure, monetary and follow up etc. of DYD, DWA, LGED and BRDB have some similarities with minor modification in their operational culture. However, DYD served for the self-employment programme more visibly compared to three other programmes in respect of volume of credit per head invested, repayment record and monitoring of the performance of the beneficiaries. In case of social development, DYD concentrates more on development through income raising and project implementation whereas the other organization are based on micro project approach implemented at the village level for social development of beneficiaries on both welfare self-reliant basis. The current practice of preparing monthly reports for the purpose of internal evaluation is much needed procedure and these report loose in value if action is not taken in the less performing village on the basis of the monthly reports. This practice is very much active in case of DYD other than three organizations under the study. As part of the internal audit, this is being practiced currently at the DYD. Only recently one percent of service charge has been allocated for handling the legal matters, which as a right step forward whereas such type of arrangement specially for handling the default loan is not so much visible in other three organizations.

In fine, the comparison revealed that the DYD performed better in respect of training imparted, grace period and number of installments to be paid in a year than the other three agencies under study as far as micro credit landing to poor borrowers is concerned. However, the major worrying

factor is problem of default culture among the beneficiaries both under self-employment schemes as well as village base family credit. These issues should be addressed carefully.

IV. SUMMARY OF FINDINGS:

General Findings:

a) Out of total respondents (1110), 650, 87, 297 were trained under self-employment, technical training and youth training centre respectively. As a result of skill development training, the youth could engage themselves in different types of income generating activities by utilizing the training and earning money through their employment resulting in contribution to their family as well as to the community. They have been oriented also about different aspects of moral and social development as an integral part of the training courses.

b) Most of the educated trained youth have changed their attitude towards self-employment rather than jobs. An insignificant number of education trained youth are facing social and family level problem about the self-employed trades since employment were not commensurate with their family status in the community.

c) It was found that, in terms of education and age, DYD rightly selected youth, 87% form eight and above education level while 92% belonged to the age group 18-35 years.

d) Among the surveyed households (1110), 402 (36%) were female which indicates the presence of a cognizable level of gender balance among the trained youth under DYD programmes.

e) Regarding the extent of coverage under the three different projects, it was learnt that the gap between number of rural and urban trainees was found narrow in case of youth Training and Self-employment Project (on an average, 1041 for rural Upazilas and 1173 for Sadar Upazilas respectively. However, the gap was very wide for the order two projects. In case of Technical Training Project, the number of participants was 216 for Sadar Upazilas against 25for rural Upazilas on an average while in case of YTC, the number was 140 for Sadar Upazilas and 53 for rural Upazilas.

Youth Training and Self-Employment:

I) Among the three programmes, the bulk of trainees are under the youth training and self-employment project. The duration of the courses of different trades ranges between 07 days-30 days as designed by DYD. It was learnt form the study that the cost of training per participant including honoraria of trainers and logistic support was calculated to be around Tk. 50 for 07 days and around Tk. 90 for more than 07 days duration. Compared to the per participant cost of Technical Training and YTC training, the said cost of self-employment training are too insignificant to ensure quality training.

ii) The respondents opined that the training, specially mobile training, was mostly theoretical, and not enough to take initiative of self employment projects because they very level of knowledge and skill gained from this training entails high risks of failure in investment. For this reason, they recommended extended duration of course of course, greater scope for practical

training, provision for experienced trainers, and improved training facilities such as refreshment during working hours. handouts, kit boxes, enhanced honoraria etc.

iii) Respondent opined that the training was enough to serve as a starter through raising awareness and bringing attitudinal changes to involve in gainful IGAs. However, they felt that more intensive and advanced training was necessary to cover gaps of this training. Respondents also opined that selective trainees of this programme who are interested in advanced courses may be given priority in district level training under technical training and YTC training. In this way, the initial training could be linked to advanced training at district level.

iv) During selection of sample, it was observed that in most cases, the register of trained youth and their addresses were not properly maintained and recorded. Moreover, the trade and year based keeping of registers was not found. Keeping of records relating to training costs was found clumsy to a great extent.

Technical Training for Unemployed Youth:

I) In the district level courses, youth residing in and around district headquarters avail the opportunities of training in greater number, although Upazila level youth are also supposed to be enrolled for these courses in proportionate number, but in fact, it was not found in practices. The study reveals that, DYD office at four Upazilas could not provide information about the actual number of trained youth under this programme form their respective Upazilas, It leads to draw a conclusion that there is a lack of coordination between District and Upazila level DYD regarding selection of youth and maintenance of records to help follow-up the utilization of training.

ii) The respondents recognized the importance of secretarial science course in the present job market. However, they opined that computer should be included in this courses since now-a-days computer is essential for doing secretarial jobs. Opinions were given by the respondents to widen the scope of computer training by including basic, graphics and other programmes that have high demand on the job market. They also suggested for extending the course duration.

***YTC Training*:**

I) Under this programme, 1041 youth were trained by YTC in the selected Upazilas. YTC provided three months capsule training (livestock, poultry fishery & agriculture), which was residential. The participants opined that the training package was mostly theoretical and could not comprehensive cover the four areas because of short duration compared to the very wide scope of the module. As a solution to this limitation, they suggested that at the beginning, a common basic courses be imparted to all participants for one month and following that subject matter specific separate courses on the four different areas be organized. At the second stage, participants will be divided into trade groups. They will choose any of the four areas for specialization so that they

can gain enough skill a particular occupation instead of being jack-of-all-trades.

ii) In none of the selected Upazilas, register of YTC trained youth was found. YTC authority did not supply the list of trained youth to the Upazila office. It was collected form YTC via district office. It was learnt that the absence of proper record of YTC trained youth in Upazila DYD hampered credit distribution and monitoring of post training utilization by Upazila level officials.

iii) The respondents expressed reservation about the quality of trainers. They opined that the trainers should have more sound theoretical and practical knowledge. In the Composite index (CI) measurement, overall satisfaction about standard of theoretical and practical knowledge gained through DYD training was 56% and 55% respectively. The self-employment training obtained the lowest acre (51% and 49%). They also mentioned their concern the about absence of practical training facilities at YTC, such as demonstration.

iv) It was found that the need based training provided under the technical training project is more effective regarding the employment opportunity rather than the training provided under self-employment project and youth training centre project. It was strongly recommended that DYD needs to open marketing channels for the product of trained youth. One of the measures can be introduction of show rooms at convenient market places in cities.

V. RECOMMENDATIONS:

On the basis of the suggestions of the respondents (both youth stakeholders and officials), the following measures are recommended to enhance the quality of training, strengthen post training utilization measures and also to make training cost effective:

I) An umbrella coordination mechanism would be required, first, to link the three programmes, and second, to develop a functional linkage among Upazila DYD, district level DYD and YTC. Deputy Director at District level can be made the focal pint and principal controlling authority. A coordination mechanism would be needed in the selection of trainees for self-employment training, technical training and YTC package training. A selection committee can be formed through inclusion of official from YDO office, YTC and district level offices to oversee the selection of trainees at three level.

ii) The mutual supply of list of trainees by Upazila office. District level office and YTC to one another on a regular basis would be needed to ensure post training support like credit, monitoring and supervision. Interested youth trained through mobile training should get priority in YTC training and technical training for advice learning. This would help increase youth entrepreneurs at grass-roots level

iii) District level DYD should evolve a mechanism so that proportionate number of grassroots youth can take part in technical training courses side by side with urban youth. A uniform and simplified record keeping mechanism should

be evolved and put into practice so that Upazila office can keep trade wise registers of training and credit and properly record name sand addresses of trainees and borrowers, The accounts keeping of trading courses needs to be streamlined through introducing a simplified and uniform format.

iv) To enhance the effectiveness of record keeping, Upazila level DYD should be equipped with computer facilities and record keeping of training and credit needs to be computerized.

v) The YTC training duration can be extended from 3 to at least four months, The package can be divided into two modules (a) basic course for all trainees and (b) subject specific separate modules to be attended by selective trainees according their preferences. After completion of one month basic module, trainees can be divided into subject specific groups form the second month.

vi) To encourage increased participation of grassroots youth in district level technical training and also to enable participants to get extended time for learning, the technical courses at district level should be made residential,

vii) The overall training budget of all categories of courses, specially of mobile training needs to be enhanced. This would be needed to ensure required logistics including handouts and AV aids.

viii) Area specific training needs should be explored. For example, for regions like Teknaf, special courses on shrimp culture, saline water fish culture, sail cultivation, tree plantation, production of handicraft for tourists etc. can be introduction. Similarly for regions like Rajshahi, silkworm cultivation, vegetable dye making, kantha making for babies etc can be considered as prospected into a single courses through extending courses duration.

ix) The modules of different courses should be redesigned on the basis of current needs. For example, computer training can be incorporated to secretarial science course to augment the training impact. For practical learning, internship can be introduced in technical courses such as electrical, welding, air conditioning, refrigeration; participants can be attached to workshops, factories

References:

1. Abedin, Zainul, M(,2005) "***Role of Youth Department in Poverty Alleviation & Employment Generation*** ", National Youth Centre, DYD, Dhaka,
2. Alam, Mohammad Shahidul(2004), *"**Some Thoughts on National Youth Policy**",* National Youth Centre, DYD, Dhaka,
3. Ali, Md. Easin (1999), "***Impact of Skill Development Training on Pro-Active Rural Youths for their Self-employment in CVDP Village*****"**, Comilla, BARD.
4. Ali, Md. Easin (2000).,***Management of Different Village Level Groups and their Development Programme by Women: problems and Prospects**,'*** UNDP, BARD, Comilla.
5. Ali, Md. Easin . (2005) "***Utilization Status of Financial Grants Given by the Ministry of Youth & Sports to the Youth Organization and Identification of Passable Linkage Networking.**"* NYC, Savar, DYD, Dhaka.
6. Ali, M. Easin, Hasan, S.M. Quamrul and Malek M.

Abdul(2003) "***Impact of Youth Development Progamme on Human Development in CHT Division: An Evaluation***" Department of youth Development, Dhaka,

7 Ali, M. Easin, Roy, M.K. & Bhattacharjee, M. K(2006)." ***An effectiveness of the ongoing Programmes of Department of Youth Development,****"*BARD, Comilla,

8. *GoB(2003),* ***Unlocking the Potential : National Strategy for Accelerated Poverty Rduction****".* General Economics Division, Planning Commission, Dhaka.

9. GoB(2005) "***Success Stories of Self-employed Youth(2005)*****",** DYD, Dhaka. ,

10 Hagigi,Moshe & Lin,Ling(2012)" ***Attifude Towards Risk and Entrepreneurship Development in Emerging Economics: The Case of Bangladesh****"* Independent Business Review, Vol: 5, NO: 1,January, Independent University Bangladesh (IUB), Dhaka,2012

11 Hedge,Sidh ***Youth Yo Work****",* London,ThePilgrin Press, 1960

12 Hytti.U & O" Gorman,C(2004), What is enterprise Education ? An analysis of the Objectives & Mathods of Enterprise Education Programme in four European Countries,***Education & Training 46(1),11-23,***

13 Lorwin,L.Lewis(1941)" ***Youth Work Programme,Problems & Policies***", Washing Americian Council of Education,

14 International Labour Office(1972) "***Traini Youth ng and Employment Schemes in Developing Countries*****"**, Geneva, International Labour Offices.

15 Momen, Abadu(20005), *Youth Programmes in SAARC Countries*", National Youth Centre, DYD, Dhaka.

16. Rahim, A(1976) Sabuj Sangha as a Youth Action Programme at Comilla Kotwali Thana*"*, Comilla, BARD.

17 Report of the Panel on Youth of the President Science Advisory Committee (1972) "***Youth: Transition to Adulthood***" Chicago and Laondon, The University of Chicago Press

18. Roy, Mihir Kumar (2000). ***Linkage Between GOs & NGOs in Rural Credit: A study of some credit pgorammes in Bangladesh,*** BARD, Comilla.

19 Samad, Quazi Abdus(1998) ***Relative Performance of the Micro-credit Programme of DYD in Comparison to DSS, GB & BRAC***", NC RET, Savar, Dahak. , "

20 Sutradhar, Ashit, Kumar(2005),Youth Affairs in Bangladesh, *Batic* Printing & Publications, Monishingh Forhad Bhaban, Dhaka,

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Effect of leaf rolling and stem reserve on yield and total dry matter content of transplanted rice under various soil moisture levels

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Abstract

In Bangladesh, due to irregular rainfall during aman season between July and November rice suffers from water scarcity. In such a condition where the farmers unable to afford irrigation in boro rice field; where providing irrigation in the aman rice field seldom happens, leaving the best option to cultivate drought tolerant rice varieties in aman season. Considering the above conditions an experiment was carried out at the research field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from July to November 2014 to study the performance of four transplanted aman rice varieties (BRRI dhan56, BRRI dhan57, Binadhan-7 & BRRI dhan49) under three different soil moisture levels (100% field capacity moisture content or control, 70% of the control moisture and 40% of the control moisture). The experiment was laid out in two factors Randomized Complete Block Design with four replications. The results indicated that the highest leaf rolling score was recorded at lowest soil moisture condition in all the varieties. Under the lowest moisture condition the score was recorded the highest in Binadhan-7, which was significantly higher than any other varieties and the lowest in BRRI dhan49. In all the varieties, the lowest stem reserve translocation was recorded at control treatment and was gradually increased with decreasing soil moisture treatment. The grain yield decreased with decreasing soil moisture level in all the genotypes. But the variety BRRI dhan49 produced more than 90% relative grain yield under 70%FC treatment.

***Key words**: Aman rice, Field capacity moisture, Stem reserve translocation,*

I. Introduction

Rice is the key staple crop in Bangladesh and there is no alternative of increasing rice production to feed the ever increasing population of Bangladesh. We know that the second largest production of rice in Bangladesh comes from *aman* season after *boro*. But drought is one of the major problems in *aman* season due to prevailing climatic changes. Transplanted *aman* is the second rice crop in a year, grown in the wet *kharif II* season, between July and November; it may be strongly affected by drought spells (Selvaraj *et al*., 2006).

Abrupt ending of monsoon in September can create severe water stress on the transplanted *aman* rice (up to maximum tillering stage) and rainfall may meet the crop water demand. After October, rainfall is not sufficient for potential yield of rice and most of the *aman* rice remains at the flowering and grain filling stage at that period. If water is not supplied on those farms rice yield will be reduced drastically (Sattar and Parvin, 2009).The changing pattern of CRDs (Continuous Rainless Days) play a considerable negative role on transplanted *aman* production and might have an effect

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on water requirement in near future during this period (Rashid, 2008). The intensity of rainfall in growing period of transplanted *aman* increased but frequency and distribution pattern changed which might occur to ensure the fulfillment of water requirement demand for a certain time but not for a definite time interval which is very essential to harvest good yield for any type of agriculture crop (Basak, 2011). There are strong evidences that climate change will change the rainfall pattern and consequently more frequent droughts are happened. During the *kharif* season, it causes significant destruction to the transplanted *Aman* crop in approximately 2.32 million hectare every year (Dey *et al*., 2011). Thus it is necessary to take appropriate actions to mitigate the effect of drought in order to increase the yield of *aman* rice. Mitigation of drought can be done by-(i) supplemental irrigation, (ii) other management practices, such as changes of sowing time, fertilizer management etc. and (iii) cultivating drought tolerant varieties. It has become very expensive to irrigate b*oro* rice field and sometimes the farmers are unable to provide irrigation in *boro* rice field. In such a situation, providing irrigation in the *aman* rice field is another difficult task. Usually *aman* rice is a rainfed crop in Bangladesh. If there is no rain in proper time, the irrigation becomes necessary. It is also quite impossible to conserve soil moisture in such a big cultivable land through mulching. So, it is the best option to cultivate drought tolerant rice varieties in *aman* season.

A lot of research works have been done on drought tolerance of rice worldwide and were published in renowned journals. But in Bangladesh, research on drought tolerance as well as the soil water requirement of *aman* rice is little. The previous drought researches of *aman* rice were confined on breeding for drought tolerance and the effect of drought on *aman* rice only. Research on the identification of drought tolerant characters and determining the level of drought tolerance of different *aman* rice is new one. Therefore, the objectives of the present experiment were 1) to identify the drought tolerant aman rice variety and 2) to determine the traits for contributing drought resistance in aman rice under water scarcity environments.

II. Materials and methods

The experiment was conducted at the research farm and Plant Physiology Laboratory, Dept. of Agricultural Botany, Sher-e-Bangla Agricultural University, Dhaka-1207.

Treatments

A. Factor1(soil moisture level)
   - i) 100% FC (field capacity) moisture = S_0
   - ii) 70% of the FC moisture = S_1
   - iii) 40% of the FC moisture = S_2

B. Factor 2 (rice varieties)
   - i) BRRI dhan56
   - ii) BRRI dhan57
   - iii) Binadhan-7
   - iv) BRRI dhan49

Different data were collected on following parameters-

Leaf rolling score

Leaf rolling was assessed visually from each treatment. Several tillers were assessed and the pots were given a mean leaf rolling score, ranging from 0 to 5, with 0 being flat and 5 a tightly rolled leaf (O'Toole and Moya, 1978). These ratings were made during midday, i.e. about twice per week during the period of water deficit of all the

treatments and the average values were taken.

Stem reserve translocation (%)

To determine the pre-anthesis photosynthetic stem reserve translocation towards the final kernel weight the method described by Gallagher *et al.* (1975) has been used. This is based on the net loss in weight of above ground vegetative organs between anthesis and maturity with the difference in grain weight. It was calculated as follows-

$$\text{Stem reserve translocation (\%)} = \frac{S1 - S2}{G2 - G1} \times 100$$

Where,

S_1 = Stem dry weight at anthesis

S_2 = Stem dry weight at maturity

G_1 = Grain dry weight at anthesis

G_2 = Grain dry weight at maturity

The main stems or tillers were used to calculate stem reserve translocation. The main tillers were marked by color thread for easy identification during subsequent sampling.

Grain yield and total dry matter content of plant

Dry weight of leaves, stems and roots were measured separately with an electronic balance and recorded. Dry weight of leaves, stems, reproductive parts and roots were altogether regarded as total dry matter.

Data analysis

The data were analyzed in two factor randomized complete block design and the means were separated by DMRT at 5% level of significance using the statistical computer package program MSTAT-C (Russell, 1986). Correlation analysis was also done.

III. Results and discussion

Leaf rolling

Leaf rolling score is an eye estimation process of leaf rolling under control and limited soil moisture treatment. In the present experiment, no leaf rolling was yet observed at S0 or control treatment (Table 1) in all the varieties. The highest leaf rolling score recorded was at S2 treatment in all the varieties. Under S1 treatment, the score recorded was the highest (3.0) in Binadhan-7 which was significantly higher than any other varieties and the lowest (1.34) score was observed in BRRI dhan56 which was statistically similar to other varieties. Under S2 treatment, there existed a significant different among the varieties for leaf rolling score and the score recorded was the highest (3.67) in Binadhan-7 also, which was followed by BRRI dhan56 and the lowest (1.67) score was observed in BRRI dhan49. Leaf rolling under water stress condition helps plant to minimize transpiration loss and protect the plants from drying.

The highest leaf rolling at S2 treatment in all the varieties might be due to the lowest RWC of leaf under this treatment. But in BRRI dhan49, the leaf rolling was relatively lower in S2 treatment compared to others and this might be due to higher proline

accumulation in this variety under S2 treatment. Higher proline content increased the RWC of the leaf and the leaf rolling was lower in this variety. But in Binadhan-7, the highest leaf rolling under S2 treatment might be due to lower proline accumulation as well as lower RWC under this treatment. Therefore, leaf rolling is commonly used as an important criterion during screening of varieties for drought tolerance (Cutler *et al*., 1980; Sloane *et al*., 1990; Rosario *et al*., 1992; Lilley and Fukai, 1994). Accordingly, in the present experiment, Binadhan-7 was found to be sensitive and BRRI dhan49 was found to be tolerant to drought. Leaf rolling and leaflet closure during periods of soil moisture depletion have also been observed in other varieties of rice (Lilley and Fukai, 1994).

Table 1. Effect of different soil moisture levels on leaf rolling of transplanted *aman* rice varieties

Varieties	Soil moisture levels	Leaf rolling score		Soil moisture levels	Leaf rolling score
BRRI dhan56	S0	0.00 e	Binadhan-7	S0	0.00 e
	S1	1.34 d		S1	3.00 b
	S2	3.00 b		S2	3.67 a
BRRI dhan57	S0	0.00 e	BRRI dhan49	S0	0.00 e
	S1	1.67 d		S1	1.50 d
	S2	2.33 c		S2	1.67 d
CV (%)		20.77			20.77

S0=100%FC (field capacity) moisture, S1= 70% of the FC moisture, S2= 40% of the FC moisture. Values followed by same letter(s) did not differ significantly at 5% level of probability.

Stem reserve translocation (SRT)

The stem reserve translocation plays an important role in grain yield under water stress treatment. Among the varieties and soil moisture treatments, the highest (36.70%) stem reserve translocation recorded was in S2 treatment of BRRI dhan57 which was statistically similar to other treatments of the same variety and significantly higher than any treatment of the other variety and the lowest (24.10%) stem reserve translocation recorded was in BRRI dhan49 at S0 treatment which was statistically similar to S1 treatment of the same variety and with control treatment of BRRI dhan56 (Figure 1). In all the varieties, the lowest stem reserve translocation recorded was at control (S0) treatment and was gradually increased with decreasing soil moisture treatment.

In the present experiment, under water stress treatment the LA, SLA, plant height, effective tiller decreased. The RWC was also lower under water stress treatment that caused increased leaf rolling, decreased chlorophyll content which ultimately affected the harvesting of light. As a result, the stomatal conductance, gas exchange, RGR, AGR, and the grain filling duration became lower under water stress treatment. In this situation as the contribution of current photosynthesis towards grain become lower, the grain filling become more dependent on stem reserve. Therefore, the SRT was increased with the increasing water stress. But the difference between control stem reserve and water stress stem reserve found significant only in BRRI dhan49 and BRRI dhan56. It was clear from the present experiment that soil moisture stress increased the pre-anthesis stem reserve translocation from vegetative part to the developing grain. Extensive studies

demonstrated that water deficit treatments resulted in early senescence and more remobilization of pre-anthesis stored assimilates to grains in cereals (Yang *et al*., 2003).

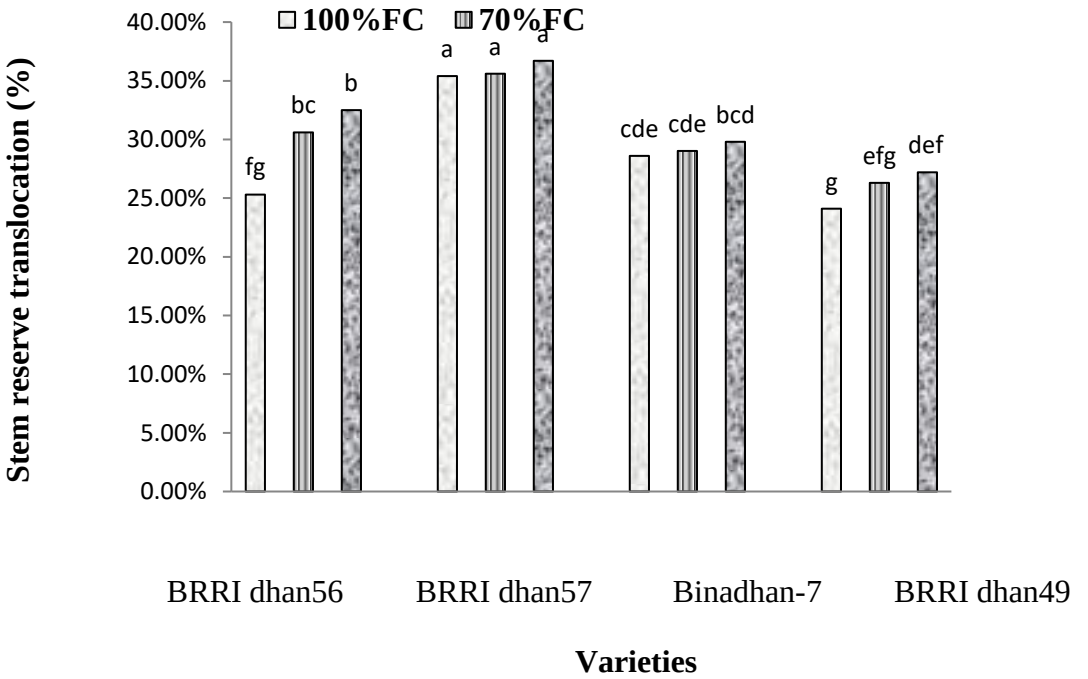

Figure 1. Stem reserve translocation towards grain of different rice varieties under various soil moisture levels. S0=100%FC (field capacity) moisture, S1= 70% of the FC moisture, S2= 40% of the FC moisture. Values followed by same letter(s) did not differ significantly at 5% level of probability.

Grain yield per plant

Finally yield per plant was calculated from different yield components. In the present experiment, the grain yield per plant differed significantly among the treatments by the interaction effect of soil moisture levels and the varieties. Considering all the varieties and soil moisture treatments the grain yield per plant recorded was the highest (31.68 g plant^{-1}) in BRRI dhan56 at S0 treatment which was significantly higher than any other treatments. The lowest (14.12 g plant^{-1}) grain yield per plant was recorded in BRRI dhan57 at S2 treatment which was statistically similar to S2 treatment of BRRI dhan56 (Table 2). In all the varieties, the highest grain yield recorded was at S0 (control) treatment which was gradually decreased from S0 to S2 treatment. The lowest grain yield per plant was recorded at S2 treatment in all the varieties. Considering the relative value, it was clear that S1 treatment had little effect on grain yield compared to control. At S1 treatment, the highest relative yield (91.7%) was

recorded in BRRI dan49, which was followed by BRRI dhan56 (86.6%) and above 80% in rest of the varieties. Considering the relative value of yield, it was recorded that the reduction was much lower in BRRI dhan49 compared to other varieties. This might be due to higher SRT under moisture stress. The results also agree with Hossain (2001). Prasad *et al*. (2012) found a significance differences in grain yield per plant in rice varieties under control and drought treatment and also stated that drought stress reduced the grain yield in different rice varieties.

Table 2. Effect of different soil moisture levels on grain yield per plant and harvest index of transplanted *aman* rice varieties

arieties	Soil moisture Levels	Grain yield per plant (g)	
		Actual	Relative (%)
BRRI dhan56	S0	31.68 a	100
	S1	27.44 c	86.6
	S2	14.15 k	44.7
BRRI dhan57	S0	23.07 f	100
	S1	19.25 i	83.4
	S2	14.12 k	61.2
Binadhan-7	S0	25.92 e	100
	S1	21.12 h	81.5
	S2	15.90 j	61.3
BRRI dhan49	S0	29.35 b	100
	S1	26.90 d	91.7
	S2	22.48 g	76.6
CV (%)		0.13	

S0=100%FC (field capacity) moisture, S1= 70% of the FC moisture, S2= 40% of the FC moisture. Values followed by same letter(s) did not differ significantly at 5% level of probability.

Relationship between leaf rolling and grain yield

In the present experiment, it was recorded that the grain yield was also influenced by leaf rolling. The leaf rolling helped plants to minimize transpiration loss under water limiting treatment. As a result, the relative water content of leaf might be less affected under water stress treatment. On the other hand, higher leaf rolling might decrease light harvest as well as different physiological processes in leaf, which ultimately affect grain yield. The relationship between leaf rolling and grain yield of different rice varieties under various soil moisture treatments was recorded in the present experiment. It was observed that there was a highly negative linear relation between leaf rolling and grain yield (Figure 2). Grain yield was found the lowest when the leaf rolling was the highest. The grain yield recorded was the highest when the leaf rolling was the lowest. The grain yield was gradually decreased with the increasing leaf rolling score. Kumar *et al.* (2011) found that grain yield was significantly and negatively correlated with leaf rolling, leaf drying and spikelet sterility under drought stress treatment.

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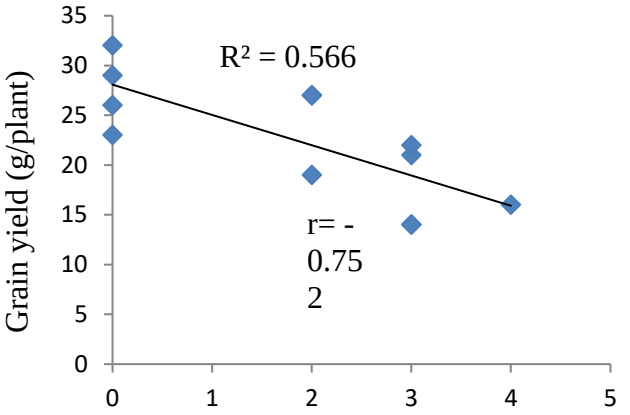

Figure 2. Relationship between leaf rolling score and grain yield of different rice varieties under various soil moisture treatments.

Total dry matter (TDM) content of plant

Total dry matter content is the major determinants of growth and development. Water stress had a significant effect on root and shoots dry matter as well as the total dry matter production in rice plant. There were genotypic variations also. The TDM of the plants was measured after harvest. Among the varieties and soil moisture treatments, the total dry matter content was found the highest (54.01 g) in BRRI dhan56 at S0 treatment which was statistically similar to S0 treatment of Binadhan-7 and with S0 treatment of BRRI dhan49 (Table 3). In BRRI dhan57, the highest TDM content was also found in S0 treatment. In all the varieties, the highest TDM was recorded at S0 or control treatment and the lowest TDM was produced at S2 treatment. Considering all the varieties and soil moisture treatments, the TDM recorded was the lowest (31.35 g) in BRRIdhan57 at S2 treatment which was statistically similar to S2 treatment of BRRI dhan56. In BRRI dhan56, the percent reduction of total dry matter of plant was 7.35% of the control at S1 treatment and the reduction percentage was 36.18% in case of S2 treatment in the same variety. In BRRI dhan57, the reduction percentage at S1 treatment recorded was 2.97% of the control and in the same variety the reduction percentage was 24.93% of the control at S2 treatment. In Binadhan-7, the reduction of TDM of plant was 15.76% of the control at S1 treatment and the reduction percentage was 22.19% of the control at S2 treatment. In BRRI dhan49, the reduction of TDM of plant was much lower (only 0.08% of the control) at S1 treatment and at S2 treatment the reduction of TDM recorded was 21.09% of the control.

So, in the present experiment, the total dry matter production was decreased with decreasing soil moisture levels. This might be due to the reduction of various morphological and physiological processes; that included reduction in LA, SLA, RWC, stomatal conductance, gas exchange, sugar-starch synthesis and NAR etc, resulting in

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decreased water use efficiency and TDM content of plant. These results confirmed with Tuna *et al*. (2010). Sokoto and Muhammad (2014) stated that water stress at tillering resulted in lower biomass than water stress at flowering and grain filling or no stress control which were statistically similar. Rice grown in drought stress treatment produced significantly less total biomass than irrigated rice (Kumar *et al*., 2014a)

Table 3. Effect of different soil moisture levels on root total dry matter (TDM) production of transplanted *aman* rice varieties

Varieties	Soil moisture levels	Total dry matter per plant (g)	Reduction Percent of TDM per plant (%)
BRRI dhan56	S0	54.01 a	
	S1	50.04 b	7.35
	S2	34.47 d	36.18
BRRI dhan57	S0	41.76 c	
	S1	40.52 c	2.97
	S2	31.35 d	24.93
Binadhan-7	S0	51.96 ab	
	S1	43.77 c	15.76
	S2	40.43 c	22.19
BRRI dhan49	S0	52.91a b	
	S1	52.87 ab	0.08
	S2	41.71 c	21.17
CV (%)		5.28	

S0=100%FC (field capacity) moisture, S1= 70% of the FC moisture, S2= 40% of the FC moisture. Values followed by same letter(s) did not differ significantly at 5% level of probability.

IV. Conclusion

Different morphological and physiological processes of rice plant are affected by limited soil moisture content. In the present experiment under 100%FC condition all the rice varieties showed no leaf rolling at all and lower stem reserve translocation. But the highest leaf rolling and stem reserve translocation was observed at 40%FC condition in all varieties. It was revealed that BRRI dhan49 and BRRI dhan56 showed lower leaf rolling, relatively higher stem reserve translocation and relatively higher grain yield as well as higher total dry matter content under water stress condition compared to rest of the varieties. So the rice varieties BRRI dhan49 and BRRI dhan56 could be cultivated under low soil moisture condition (under 70% of the field capacity moisture) without any remarkable effect on its yield potentiality under field condition but saving a large amount of irrigation water during aman season.

V. References

Basak, J. K. (2011). Changing rainfall pattern effects on water requirement of T. aman cultivation in Bangladesh. *Public J. Environ. Sci*., **11**(1): 1-8.

B.C.A. (2004). Bangladesh Country Almanac. BCA, CIMMYT, Bangladesh, Dhaka-1230. http://www.cimmytbd.org/bca/.

Cutler, J. M., Shahan, K. W. and Steponkus, P. L. (1980). Dynamics of osmotic adjustment in rice. *Crop Sci.*, **20**: 210-314.

Dey, N. C., Alam, M. S., Sajjan, A. K., Bhuiyan, M. A., Ghose, L., Ibaraki, Y. and Karim, F. (2011). Assessing environmental and health impact of drought in the northwest Bangladesh. *J. Environ. Sci. & Nat. Resour.*, **4**(2): 89-97.

Gallagher, J. N., Biscoe, P. V. and Scott, R. K. (1975). Barley and its environment. V. Stability of grain weight. *J. Appl. Ecol.,* **12***:* 319-336.

Hossain, M. A. (2001). Growth and yield performance of some boro rice cultivars under different soil moisture regimes. M.S. Thesis, Department of Crop Botany. Bangladesh Agric. Univ., Mymensingh.

Kumar, S., Dwivedi, S. K., Singh, S. S., Bhatt, B. P., Mehta, P., Elanchezhian, R., Singh,V. P. and Singh, O. N. (2014a). Morpho-physiological traits associated with reproductive stage drought tolerance of rice (*Oryza sativa* L.) genotypes under rain-fed condition of eastern Indo-Gangetic Plain. *Indian J. Plant Physiol*., **19**(2): 87–93.

Kumar, Y., Singh, B.N., Verma, O.P., Tripathi, S. and Dwived, D.K. (2011). Correlation and path coefficient analysis in scented rice. *Environ. Ecol.,* **29**: 1550-1556.

Lilley, J. M. and Fukai, S. (1994). Effect of timing and severity of water deficit on four diverse rice cultivars. 1. Rooting pattern and soil water extraction. *Field Crops Res*., **37**: 205-213.

O'Toole, J. C. and Moya, T. B. (1978). Genotypic variation in maintenance of leaf water potential in rice. *Crop Sci.,* **18**: 873 - 876.

Prasad, S., Singh, M. P. and Yadav, R. K. (2012). Physio-chemical changes in rice varieties under drought stress condition. *Plant Archives,* **12**(1): 63-66.

Rashid, M. A. (2008). Personal communication with Md. Abdur Rashid, Principle Scientific Officer, BRRI, Gazipur, Bangladesh.

Rosario, D. A., Ocampo, E. M., Sumague, A. C. and Paje, M. C. M. (1992). Adaptation of vegetable Legumes to drought stress. In C. G. Kuo (Ed.), *Adaptation of food crops to temperature and water stress*. In 13-18 August, Taiwan. Asian Vegetable Research and Development Center (AVRDC), Shanhua, Taiwan. pp.360 - 371.

Russell, D. F. (1986). MSTAT-C Pakage programme. Crop and Soil Science, Department, Michigan University, USA.

Sattar, M. A. and Parvin, M. I. (2009). Sustainable T. *aman* rice production in North-West region of Bangladesh for food security under climate change situation, Proceedings of the International Conference on Climate Change Impacts and Adaptation Strategies for Bangladesh, pp. 189-300.

Selvaraj, M., Singh, N. S., Roy, S., Sangeetha, R., Varshney, U. and Vijayan, M. (2006). Acta Cryst., **62**: 913-915.

Sloane, R. J., Patterson, R. P. and Carter, I. E. (1990). Field drought tolerance of a soybean plant introduction. *Crop Sci.,* **30**: 118 -123.

Sokoto, M. B. and Muhammad, A. (2014). Response of rice varieties to water stress in Sokoto, Sudan Savannah, Nigeria. *J. Biosci. Medi*., **2**: 68-74.

Tuna, A. L., Kaya, C. and Ashraf, M. (2010). Potassium sulfate improves water deficit tolerance in melon plants grown under glasshouse conditions. *J. Plant Nutri*., **33**(9): 1276-1286.

Yang, J., Zhang, J., Wang, Z., Zhu, Q. and Liu, L. (2003). Involvement of abscisic acid and cytokinins in the senescence and remobilization of carbon reserves in wheat subjected to water stress during grain filling. *Plant Cell Environ.*, **26**(10): 1621-1631.

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Yield and Yield Components of Bottle Gourd (Lagenaria Vulgaris L) Genotypes as Influenced by Different Light Levels

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Abstract

The present investigation was carried out at the research farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207. Low light responses of three bottle gourd genotypes (High-green, BARI Lau-1 and Local white) were investigated in the present study in terms of their yield contributing characters and yield. The light treatments consisted of (i) 100% photosynthetically active radiation (PAR) measured in the open field and (ii) 75%, (iii) 50%, (iv) 25% of natural PAR obtained by using mosquito nets of variable color and mesh number. Under 75%PAR level, fruit number per plant, fruit length, fruit diameter, individual fruit weight and fruit yield per plant were recorded higher than control treatment. Under 75% and 50%PAR level, the High-green and Local white varieties produced higher yield than control treatment. But in BARI Lau-1, only 75%PAR level produced higher yield than control treatment. The overall results indicated that High-green and Local white were less sensitive and BARI Lau-1 was more sensitive to low light.

***Key words**: Bottle gourd, Photosynthetically active radiation (PAR), Yield contributing characters.*

I. Introduction

Bottle gourd is one of the most important vegetables grown worldwide. Due to its crisp, soft, and tasty fruits, it is equally liked by rich and poor people (Ram *et al*., 2006). The composition of immature fruits of bottle gourd per 100 g of fresh edible portion consists of water 93.9 g, energy 88 kJ (21 kcal), protein 0.5 g, fat 0.1 g, carbohydrate 5.2 g, fiber 0.6 g, a 44 mg, P 34 mg, Fe 2.4 mg, β-carotene 25 μg, thiamin 0.03 mg, niacin 1.2 mg, ascorbic acid 10 mg. The leaves per 100 g of fresh edible portion comprises: water 83.7 g, energy 180 kJ (43 kcal), protein 4.4 g, fat 0.3 g, carbohydrate 8.3 g, fiber 1.8 g, a 560 mg, P 88 mg, Fe 7.4 mg (Leghari et al., 2014). Bottle gourd belongs to the family Cucurbitaceae, is an important

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and popular vegetable in Bangladesh. High genotypic coefficient of variation values for yield/plant, number of fruits/plant, fruit length and fruit breadth and wider range of variation indicate more opportunity for selection of better genotypes (Rajesh *et al.*, 1999; Ram *et al.*, 2005). In nature, bottle gourd exhibits great morphological and genetic variability and could wide environmental adaptation (Koffi, 2009). Bangladeshi farmers used different local cultivars and released (from different organization) bottle gourd variety. But their yield is not in satisfactory level.

The improvement of vegetables production should be our main concern because they are essential food items and our dietary value depends mostly on them. In Bangladesh the per capita vegetable consumption is much lower (53 g) than its daily requirement (200 g) per head (Rashid, 1999). On the other hand the demand of vegetable crops is increasing rapidly due to the ever-increasing population. So the production of vegetable crops has to be increased. Now days, bottle gourd is grown in many countries including Bangladesh, India, Malaysia, Indonesia, Japan, China, Philippines, Taiwan, Thailand, South Africa and Sudan (Yonernori and Fujeda, 1985). It grows more or less all over Bangladesh. Young bottle gourd fruits are used as cooked vegetables. Its leaves and tender stems are also used as delicious nutritious vegetables. Each 100 g bottle gourd contains 1.1 g protein, 5.1 g carbohydrates, 0.1 g fat, 0.6 g minerals and some vitamins (Haque, 1985). In nature, bottle gourd exhibits great morphological and genetic variability and could wide environmental adaptation (Koffi, 2009).

In Bangladesh, bottle gourd is a popular winter vegetable. It is found to cultivate in commercial way in the field as well as homestead in rural Bangladesh (Quamruzzaman et al. 2017). It occupies about 12,100 ha of land and the production is 101,325 tons per year. The national average yield of bottle gourd is only 9.38 tons/hectare (Islam and Uddin, 2015), which is much lower than the other tropical countries. This low production may be either due to lack of high yielding varieties or poor fertility management. On the other hand the crop area is decreasing day by day. So the only possible way for increasing the production of bottle gourd may be growing associated with other crops/trees. Bottle gourd may be grown with tall growing crops or trees. Even through this system of intercroping gives additional yield advantage and monetary benefit. But bottle gourd is sensitive to reduced light level and often suffers due to shading caused by associated crop. Growth of autotropic plants is directly and dramatically influenced by light intensity (i.e. quantum flux density) which is the driving force of photosynthesis and provides nearly all of the carbon and chemical energy needed for plant growth, After that, chlorophyll absorbs light energy and lets photosynthesis happen ("Photosynthesis," 2015) . Yield

reduction by shading will depends upon crop species as well as the degree of shading. The degree of shading is generally controlled by the nature, age and characteristics of upper story trees. Most of the families of Bangladesh depend on the vegetables which are growing in the homestead areas where shade is unavoidable due to standing trees. So, there is tremendous need to screen these vine type vegetables under low light environment for evaluating their adaptability and yield potential. To serve this purpose, higher yielding and partial shade tolerant bottle gourd should be introduced. Considering the above mentioned facts three bottle gourd genotypes were grown to evaluate their yield contributing characters and yield under reduced light condition. Considering the above mentioned facts, the present experiment was conducted with the following objectives:

a) To evaluate the yield and yield contributing characters of bottle gourd under reduced light condition.

b) To identify the most suitable sun light intensity for its better growth and development.

II. Materials and Methods

The research work was conducted at the Research field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. The experimental field is located at 90°22'E longitude 23°41'N latitude at an altitude of 8.6 meter above sea level. The soil was clay loam in texture. Organic matter content was very low (0.82%) and soil pH varied from 5.47-5.63. Four light treatments were evaluated in this study viz. T_1 =100% Photosynthetically Active Radiation (PAR) or Full sunlight, T_2 =75% PAR, T_3 =50% PAR and T_4 = 25% PAR. The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications. The individual (unit) plot size for bottle gourd was 3 m × 2 m. Adjacent plots and neighboring blocks were be separated by 1.5 m and 1.0 m space.

Three bottle gourd varieties; such as High-green, BARI Lau-1 and Local white were used in this experiment. The seedlings were raised first on separate seed beds or polybags followed by planting on the experimental plots and then these were supported by trellis framed in combination with bamboo and rope. After crop establishment, nylon nets of different sieve size were hanged with the help of bamboo sticks at a height of 2.3 meters to create low light treatments. Low light treatments consisted of 75% photosynthetically active radiation (PAR), 50% PAR and 25% PAR. The control treatment consisted of full sunlight or 100%PAR. Manure and fertilizer was applied at following rate according to the recommendation. Urea, TSP and MP was applied as 90, 75 and 60 kg ha 1. Beside these, cowdung @ 10 t ha 1 was also applied. At the time of land preparation, half of the cowdung was applied. Rest of the cowdung and the whole quantity of TSP were applied 15 days prior to transplanting in the pit.

The urea and muriate of potash was applied in two installments consisting of ½ at each installment. The first installment was applied 10 days after transplanting the seedlings. The second installment was applied at 20 days after the first installment.

Data on fruit number plant^{-1}, fruit length, fruit diameter, individual fruit weight, fruit yield/plant and total fruit yield were recorded. Data obtained from the experiment for each parameter was analyzed following MSTAT-C software to obtain the level of significance. The mean differences among the treatments were compared by Least Significant Difference Test at 5% level of significance.

III. Results and Discussion

Yield and yield components

Taking the average values of three bottle gourd genotypes, it was recorded that 75%PAR level produced the highest fruit number/plant (7.97) which was followed by control treatment (100%PAR). The lowest fruit number/plant was recorded in 25%PAR level (2.03). The highest fruit length (35.20 cm) was found in 75%PAR level also, which was followed by control treatment (33.59 cm). The lowest fruit length was recorded in 25%PAR level. The fruit diameter was recorded highest in 75%PAR and lowest in 25%PAR level. The individual fruit weight was also found highest (1662.67 g) in 75%PAR level, which was followed by control treatment and a drastic reduction in individual fruit weight (347.13 g) was recorded in 25%PAR treatment. The fruit yield /plant was recorded highest at 75%PAR treatment also. The lowest fruit yield per plant (4.71kg) was found in 25%PAR treatment.

Table 1. Effect of different light levels on different yield contributing characters of three (3) bottle gourd genotypes.

Light level (% PAR)	Fruit numbers/plant	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield/ plant (kg)
100	7.71	33.59	19.15	1520.27	9.95
75	7.97	36.20	20.5	1662.67	15.36
50	6.46	29.45	19.9	1240.57	9.56
25	2.03	12.80	10.05	347.13	4.71
$LSD_{(0.05)}$	2.31	6.28	2.11	71.44	3.64
CV (%)	15.05	11.33	14.36	11.24	17.11

It was recorded from the average of four light levels in bottle gourd genotypes that High-green genotype produced the highest fruit number per plant (7.04) which was followed by Local white genotype. The lowest fruit number per plant was recorded in BARI Lau-1 (5.41). The highest fruit length (40.58 cm) was found in High-green genotype also, which was followed by BARI Lau-1 (25.01 cm). The lowest fruit length

was recorded in Local white genotype. The fruit diameter was recorded highest (21.05 cm) in High-green genotype and lowest was recorded in Local white genotype. The individual fruit weight was found highest in High-green and the lowest was found in BARI Lau-1 genotype. The fruit yield per plant was found highest in High-green genotype also and the lowest fruit yield per plant was recorded in Local white genotype but was statistically similar with BARI Lau-1 genotype.

Table 2. Different yield contributing characters of three (3) bottle gourd genotypes average of four light levels.

Genotypes	Fruit numbers/plant	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield/ plant (kg)
V_1	7.04	40.58	21.05	1550.93	12.76
V_2	5.41	25.01	16.16	1038.80	9.20
V_3	5.79	18.63	14.84	1051.95	7.88
$LSD_{(0.05)}$	1.36	5.02	3.27	75.80	3.73
CV (%)	15.05	11.33	14.36	11.24	17.11

V_1 = High-green, V_2 = BARI Lau -1 and V_3 = Local white

The highest fruit numbers per plant was found at 75% PAR level in High-green and BARI Lau-1 varieties. In Local white variety the highest fruit number (7.34/plant) was recorded under full sun light. Among the genotypes BARI Lau-1 produced the highest number of fruit (8.91/plant) at 75% PAR level and did not produced any fruit at 25% PAR level. Fruit length was the highest in High-green and BARI Lau-1 varieties at 75% PAR level but in Local white the fruit length was the maximum (20.25 cm) under full sun light. The minimum fruit length found under 25% PAR level in all the genotypes. The highest fruit diameter was observed at 75% PAR level in all the genotypes. Among the varieties the highest fruit diameter was found in High-green (24.25 cm) at 75% PAR level and the lowest (14.71 cm) in Local white genotype under full sun light. Low light did not affect much in fruit diameter up to 50% PAR level in all varieties. The heaviest individual fruit (1904.3 g) was recorded in High-green genotype at 75% PAR level. The significant difference in individual fruit weight was found among the genotypes in a particular light level. The fruit weight was adversely affected under 25% PAR level in all the varieties. The highest fruit yield (20.30 kg) was observed in BARI Lau-1 variety under 75% PAR level. This might be due to highest number of fruit/plant in BARI Lau-1 at 75% PAR level; which ultimately contributed in highest fruit yield of this genotype under the same

PAR level. Among the varieties tested the fruit yield was found to the lowest in BARI Lau-1 at 50% PAR level, which might be due to small fruit size of this variety under 50% PAR level. This result revealed that all the varieties of bottle gourd showed their best performance under 75% PAR level compared to other light levels and fruit yield did not markedly reduced up to 50% reduced light level except BARI Lau-1 variety.

Table 3: Effect of different light levels on yield contributing characters of three bottle gourd varieties

Light level (% PAR) X variety	Fruit numbers/plant	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield/ plant (kg)
100 x V_1	8.17	42.51	20.74	1495.5	10.95
x V_2	7.62	38.00	22.00	1676.0	11.74
x V_3	7.34	20.25	14.71	1389.3	7.17
75 x V_1	8.79	50.20	24.25	1904.3	16.44
x V_2	8.91	39.40	22.30	1678.7	20.30
x V_3	6.21	19.00	14.95	1405.0	9.34
50 x V_1	8.51	47.45	23.80	1771.0	15.18
x V_2	5.12	22.64	20.35	800.5	4.75
x V_3	5.74	18.26	15.55	1150.2	8.75
25 x V_1	2.70	22.15	15.42	1032.9	8.46
x V_2	0	0	0	0	0
x V_3	3.4	16.26	14.74	8.50	5.67
$LSD_{(0.05)}$	3.39	6.27	4.11	139.46	5.09
CV (%)	15.05	11.33	14.36	11.24	17.11

V_1 = High-green, V_2 = BARI Lau -1 and V_3 = Local white

Total yield (t/ha)

The total yield indicated the fruit yield of all plants of a treatment. In the present experiment, it was recorded that the highest yield was produced in 75%PAR in every genotype. In High-green and Local white, the 50%PAR treatment produced higher yield than control treatment. The 50%PAR treatment of BARI Lau-1 produced lower yield than control (100%PAR) treatment. The 25%PAR treatment of High-green and Local white produced the lowest yield. 25%PAR treatment of BARI Lau-1 did not produce any yield; indicated that BARI Lau-1 is very much sensitive to 25% PAR or lower than that.

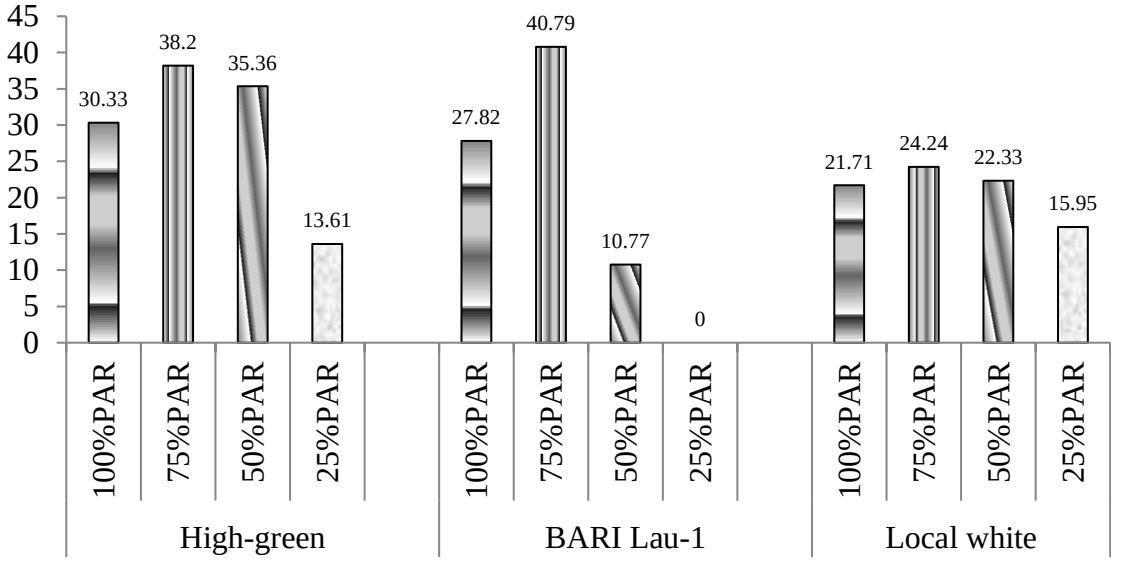

Figure 1. Total yield of three bottle gourd genotypes under different light levels.

IV. Conclusion

The overall results revealed that the degree of tolerance to low light vary among the varieties

of bottle gourd. All the varieties of bottle gourd produced higher yield than control in 75%PAR level. Among the three varieties of bottle gourd, namely BARI Lau-1 produced the highest relative yield which was followed by High-green. Under 50%PAR level, only High-green produced the higher yield than control. These results indicated that 75%PAR level is suitable for all the genotypes of bottle gourd and can give better yield than control under this PAR level. Overall results suggested that bottle gourd variety High green is well suited for growing as understorey crop. However, further experiments are needed with more number of genotypes/ varieties to explain the shade tolerant mechanism of bottle gourd.

V. References

[1.] Anonymous. 2005. Year Book of Agricultural Statistics of Bangladesh 2002. Bangladesh Bureau of Statistics, Ministry of Planning, Government of People's Republic of Bangladesh, Dhaka, Bangladesh. pp 94-102.

[2.] Bjorkman, O. 1981. Responses to different quantum flux densities. In: Physiological Plant Ecology (O. L. Lange, P.S. Nobel, C.B. Osmand and H. Zioglor, eds.). Part I. Springer-Verlag, Berlin,

Heidelberg, New York. pp.57-107.

[3.] Haque, E.M. (1985). Fal-Shabjir Cash 'O' Pusti Parichiti. Department of Agricultural Extension. Pp. 118-119.

[4.] Islam, M.R. and Uddin, M.Z. 2015. Ann Res Rpt Olericulture Division. pp. 26-27

[5.] Quamruzzaman, A.K.M., Rahman MM and Akter L. 2017. Performance of Bottle Gourd Lines in Bangladesh Condition. Annals of Biological Sciences. 5(1):5-7

[6.] Koffi KK, Anzara GK, Malice M, Dje Y, Bertin P, Baudoin J, Zoro Bi IA. 2009. Morphological and allozyme variation in a collection of *Lagenaria siceraria* (Molina) Standl. from Cote d'Ivoire. Biotechnol. Agron. Soc. Environ. 13(2), 257-270.

[7.] Leghari, M.H., Mugheri, A.A., Sheikh, S.A., and Wahocho, N.A. (2014). Response of nitrogen levels on the growth and yield of bottle gourd varieties. International Journal of Agronomy and Agricultural Research (IJAAR), 5(6):86-92.

[8.] Photosynthesis. (2015). In *The Columbia Encyclopedia* (6th ed.). The Columbia University Press.

[9.] Rajesh K, Singh DK, Ram HH, Kumar R. 1999. Manifestation of heterosis in bottle gourd (*Lagenaria siceraria* (Mol) Stand L.). Annals of Agril. Res. 20(2), 177-179.

[10.] Ram D, Rai M, Rai N, Yadav DS, Pandey S, Verma A, Lal H, Singh N, Singh S. 2006. Characterization and evaluation of winter fruited bottle gourd, *Lagenaria siceraria* (Mol.) Standl. Proceedings of 20th International Conference on Industrial Engineering and Vegetables. Leg, pp. 89-98.

[11.] Ram D, Singh RS, Pandey S, Rai M. 2005. Study of polygenic traits in off season bottle gourd (*Lagenaria siceraria* (Mol) Stand L.). Veg. Sci. 32(2), 189-191.

[12.] Rashid, M.M., 1999. Shibji Biggan, 2 edn. Rashid publishing House, 94 Puraton DOHS, Dhaka, Bangladesh, pp: 243-385.

[13.] Yonernori, S. and Fujeda, K. (1985). Sex expression in bitter gourd (*Momordica charantia* L.) Science Bull., College of Agriculture, University of Ryukyux, Okinawa. 32: 183-187.