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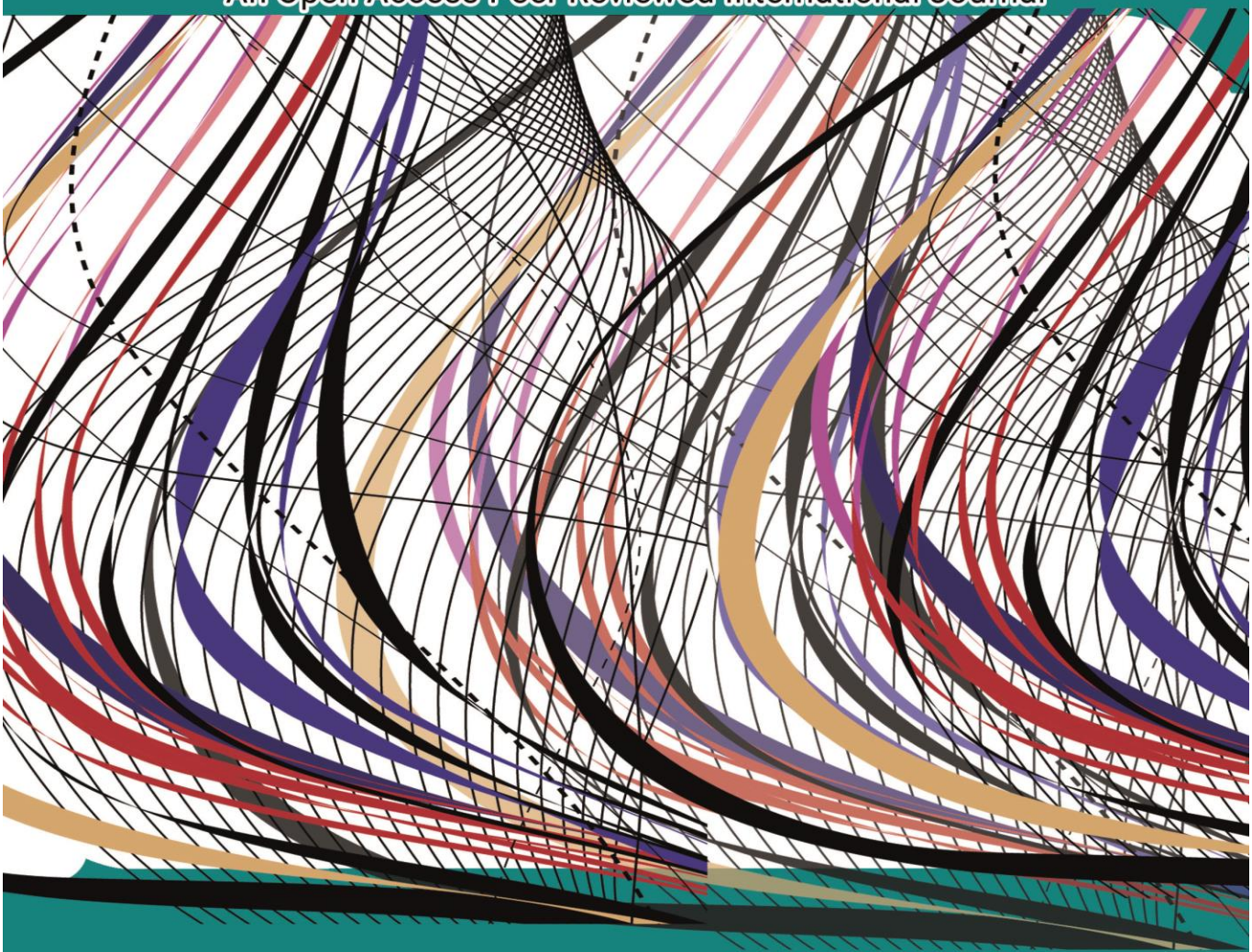

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FOREWORD

I am pleased to put into the hands of readers Volume-5; Issue-3: Mar, 2019 of **"International Journal of Advanced Engineering, Management and Science (IJAEMS) (ISSN: 2354-1311)" ,** an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers.

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

Dr. Uma Choudhary
Editor-in-Chief
Date: April, 2019

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Artificial Neural Network Model for Compressive Strength of Lateritic Blocks

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***Abstract*—** *Lateritic soil are locally abundant and relatively cheap to be used for block production. Its use has gone a long way in reducing the cost of block production and construction work in general. In order to optimize the usefulness of lateritic soil, there is need to model the properties of lateritic blocks. Compressive strength is an important property of lateritic block that must be known, but it cannot be guessed easily due to the block mix proportion and processes. Statistical models used in predicting the properties of lateritic blocks operate on restricted range of data. That is, the model cannot predict input data that are outside the range of data used in developing the model. The need for a model that can predict the compressive strength of lateritic blocks for any given mix ratio became necessary. This study developed Artificial Neural Network model for predicting the compressive strength of lateritic blocks. Lateritic blocks were produced with mix ratios ranging from 1:4 to 1:12. The blocks were cured for 7, 14 and 28 days. The 28th day experimental results and results obtained from literatures on similar works were used to formulate the model. The test data were a total of 155 samples.The maximum compressive strength predicted by the model was 3.06 N/mm^2 corresponding to a mix ratio of 0.4:1:4 of water-cement ratio, cement and lateritic soil. The model accuracy was tested using Fisher test. The result of the Fisher test computations obtained 1.008 for calculated F and 3.5 for F obtained from the table. Hence the model satisfied the test. The model result also compares favourably with the experimental result.*

Keywords: Artificial Neural Network, Compressive strength, Lateritic blocks, Prediction.

I. INTRODUCTION

Lateritic blocks are composite materials made up of cement, laterite and water, moulded into various shapes and sizes. These blocks are manufactured by the process of mixing the constituent materials, molding and ejecting of formed blocks. The quality of blocks differs from place to place as a result of discrepancy in the properties of constituent materials, the mix proportion of the constituents and method employed in production.

According to [1] lateritic blocks were made by the Nigerian Building and Road Research Institute (NBRRI) and used for the construction of a bungalow. NBRRI proposed the following minimum specification as requirements for lateritic blocks, bulk density of 1810kg/m^3, water absorption of 12.5 %, and compressive strength of 1.65N/mm^2 with maximum cement content fixed at 5%.

The compressive strength of block is one of the most important and useful property of blocks/concrete. It is used as a qualitative measure for other properties of blocks. Compressive strength of block must be known in other to model the behavior of laterite block structure. It cannot be guessed easily due to the constituent proportion of the block and the production processes [2]. The compressive strength of block is generally determined by testing blocks made in laboratory or field with the universal testing machine after 28 days curing. Loads are applied gradually till the specimen fails. Then the load at failure divided by the cross-sectional area of specimen gives the compressive strength of blocks.

Some research works have been carried out on the compressive strength of blocks, few will be discussed in this work. [3] Worked on the production and testing of lateritic interlocking blocks. The interlocking blocks were produced with lateritic samples obtained from four different locations and stabilized with 0%, 5%, 10% and 15% cement content. In their work some properties of the lateritic blocks were optimized. It was deduced from the research that all the stabilized lateritic interlocking blocks satisfied the minimum 28 days wet compressive strength of 1.0N/mm^2 recommended by the Nigeria Building and Road Research Institute.

[4]Researched on the suitability and advantages of using laterite as a soilcrete block material. The soilcrete blocks were produced were produced using 6% to 10% cement stabilization and a compressive strength of 2.15 N/mm^2 with 10% cement content was obtained. It was observed that compressive strength obtained was higher than the

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recommended value of 1.65 N/mm^2 proposed by the Nigerian Building and Road Research Institute (NBRRI) for laterite blocks.

The reliability of any model to correctly predict the block properties depends on how good the model is. Conventional methods of predicting 28 days compressive strength of blocks are based on statistical analysis which suitable regression equations have been developed to model such prediction problems. These statistical models have been observed to operate on restricted range of data. That is, the model is developed with limited range of values and if values inputted into the model are outside the proposed range, an error result is obtained. [5]It was stated in his work that choosing a suitable regression equation involves technique and experience. He highlighted that such prediction models have been developed with a fixed equation form based on a limited number of data. Therefore if the new data is quite different from the original data, the model is expected to update not only its coefficients but also its equation form.

Artificial Neural Network (ANN) is not restricted to a particular range of data or information, but needs sufficient input-output data. Artificial Neural Network (ANN) learn from data examples presented to them and use these data to adjust their weights in an attempt to capture the relationship between the model input variables and their corresponding outputs. Artificial Neural Network are data processing systems consisting of a large number of simple, highly interconnected processing elements (artificial neurons) in an architecture inspired by the structure of the central cortex of the brain. They have the ability to learn from experience in order to improve their performance and to adapt themselves to changes in the environment [6,7].

The importance of Artificial Neural Network cannot be overemphasized, as it has been used in so many areas as applied to Civil Engineering and precisely in the prediction of the compressive strength of materials. Some authors have also used ANN in structural engineering.[8] Applied ANN for predicting properties of concrete. [5] Neural Network was also used to develop a model for predicting the compressive strength of high strength concrete. In his work, 368 different high strength concrete mix design data were collected from the laboratory. Test data were assembled for high strength concrete containing cement, coarse aggregate, fine aggregate, water, fly ash, silica fume, granulated graded blast furnace slag and superplasticizer. These data were gathered for compressive strength of concrete at 28 days and range of compressive strength was from 40 to 140 MPa.

[9] The research was on the prediction of elastic modulus of concrete using artificial neural network model. In his work he was able to establish the model using 800 mixes which were supplied to the network. He stated that the coefficient of correlation, R, values of the data used for training, testing and validating the network were respectively greater than 0.90, implying that the data used in the network had a good fit. He also stated that the result obtained from his network when compared with the regression and experimental values were found to be very close.

II. MATERIALS AND METHOD

The following materials were used for the experiment;

i. Elephant Supaset cement, of class 4.25 and a brand of Ordinary Portland Limestone cement was used.
ii. The laterite was obtained from Mgbirichi, Owerri L.G.A, Imo State.It was subjected to various physical property tests and analysis.
iii. Water used for lateritic block production and curing is potable water obtained from a borehole in FUTO. The water was in conformity to the specification of [10].

2.1 Development of Artificial Neural Network Model

In this work, Feed-Forward Artificial Neural Network with Levenberg-Marquardt algorithm was used to develop the model for predicting the compressive strength of lateritic blocks. MATLAB 2014b software was the platform used. The test data were a total of 155 samples. The data were obtained from laboratory and few from similar literatures on compressive strength of lateritic blocks. The data was prepared and allowed to cover the range of inputs for which the network will be used. It was preprocessed (this is provided automatically when the network is created and it becomes part of the network object, so that whenever the network is used the data coming into the network is preprocessed in the same way.) Then was divided into subsets. The network object was created. The function "feedforwardnet" created a multi-layered network. The "configure" command configured the network object and also initialized the weights and biases of the network. When there was need to reinitialize the network, the "init" command was used. The network was ready for training, it was trained for function approximation (nonlinear regression). The training process required a set of examples of proper network behavior that is network inputs "p" and target outputs "t". The process of training the neural network involved tuning the values of the weights and biases of the network to optimize network performance. The default performance function for feedforward networks is mean square error "mse". The training was implemented using incremental training. The weights and biases of the network are updated each time an input is presented to the network. The algorithm used to optimize the performance

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function is Levenberg Marquardt backpropagation algorithm "trainlm". It performed the computations backwards through the network. Once the network was trained and validated, the object was ready to be used in calculating the network response to any input.

Different architectures were obtained for compressive strength as shown in the Table 2.The best trained network was selected. This is the network with the least mean square error. The best trained Artificial Neural Network model data for 28th day compressive strength of lateritic blocks is the bolded architecture as shown in Table 2. The best trained network was used to predict results for compressive strength of lateritic blocks. The predicted results from Artificial Neural Network for 28th day compressive strength is presented in Table 3.

III. RESULTS AND DISCUSSION

The Artificial Neural Network model was carried out for the compressive strength of lateritic blocks.The result of compressive strength is presented in Table 1. The best trained network architecture for compressive strength of Artificial Neural Network and experimental result is 0.4234. lateritic blocks is 3-71-1 with momentum and learning rate of 0.8 and 0.04 respectively as shown in Table 2. This is the bolded architecture. It has a transfer function of Logsig and Purelin and mean square error of 0.0000183. It is made up of one hidden layer and one output layer. The best trained architecture, 3-71-1 with mix ratios inputted was used to predict the compressive strength of lateritic blocks as shown in Table 3. Training window showing predicted result from Artificial Neural Network model for compressive strength of lateritic blocks is as shown in Fig 1. Results were obtained, the maximum result obtained was 3.0600 N/mm^2 while the minimum was 1.8422 N/mm^2. The adequacy of the model was tested using Fisher test as shown in Table 4. The result of the Fisher test computation obtained 1.008 for calculated degree of freedom "F" and 3.5 for "F" obtained from the table. The model was adequate since the calculated value was less than the value obtained from the "F" table. Results obtained from the model was compared with results from experiment as presented in Table 5. The results were analyzed by their percentage difference. The highest percentage difference from

Table.1: Results of 28th, 14th and 7th day Compressive strength test of Lateritic blocks

Experiment No	Mix ratios (w/c:cement:laterite)	28th day Compressive strength f_{cu}(N/mm^2)	14th day Compressive strength f_{cu}(N/mm^2)	7th day Compressive strength f_{cu}(N/mm^2)
1	0.40:1:4	3.06	1.91	1.43
2	0.46:1:5	2.90	1.74	1.23
3	0.50:1:6	2.84	1.65	1.04
4	0.63:1:7	2.64	1.61	0.94
5	0.70:1:8	2.51	1.45	0.81
6	0.74:1:9	2.48	1.20	0.72
7	0.86:1:10	2.21	0.96	0.64
8	0.88:1:11	2.09	0.92	0.58
9	1.0:1:12	1.85	0.79	0.54

Table 2: Different Architectures for compressive strength of lateritic block with Artificial Neural Network model

Network	Architecture	L-R	M	Transfer Function For hidden layers	Transfer function for output layer	Time (s)	No of Iteration	Mean Square Error (MSE)
NNTC_{15}	3-39-1	0.04	0.8	Tansig	Purelin	0:00:00	14	0.0790
NNTC_{16}	3-25-1	0.04	0.8	Tansig	Purelin	0:00:00	15	0.0000678
NNTC_{17}	3-27-1	0.04	0.8	Tansig	Purelin	0:00:01	50	0.000211
NNTC_{18}	3-55-1	0.04	0.8	Satlins	Satlins	0:00:00	14	0.00069
NNTC_{19}	3-42-1	0.04	0.8	Logsig	Purelin	0:00:00	7	0.0018
NNTC_{20}	3-33-1	0.04	0.8	Purelin	Logsig	0:00:00	8	0.2832
NNTC_{21}	3-22-1	0.04	0.8	Tansig	Tansig	0:00:04	239	0.0085
NNTC_{22}	3-44-1	0.04	0.8	Tansig	Purelin	0:00:00	9	0.0000310
NNTC_{23}	3-67-1	0.04	0.8	Tansig	Purelin	0:00:00	11	0.0243

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NNTC_{24}	3-96-1	0.04	0.8	Tansig	Logsig	0:00:00	10	0.2744
NNTC_{25}	3-42-1	0.04	0.8	Logsig	Logsig	0:00:00	13	0.2712
NNTC_{26}	3-50-1	0.04	0.8	Logsig	Logsig	0:00:00	30	0.2713
NNTC_{27}	3-88-1	0.04	0.8	Purelin	Tansig	0:00:00	10	0.0287
NNTC_{28}	3-58-1	0.04	0.8	Tansig	Purelin	0:00:00	12	0.000280
NNTC_{29}	3-38-1	0.04	0.8	Tansig	Purelin	0:00:00	7	0.0305
NNTC_{30}	3-28-1	0.04	0.8	Satlins	Purelin	0:00:00	8	0.0017
NNTC_{31}	3-21-1	0.04	0.8	Satlins	Purelin	0:00:00	10	0.000809
NNTC_{32}	3-52-1	0.04	0.8	Satlins	Poslin	0:00:00	19	0.2876
NNTC_{33}	3-46-1	0.04	0.8	Poslin	Purelin	0:00:00	11	0.0396
NNTC_{34}	3-71-1	0.04	0.8	Logsig	Purelin	0:00:22	473	0.0000183
NNTC_{35}	3-23-1	0.04	0.8	Tansig	Purelin	0:00:00	22	0.000102

Table 3: Predicted result from Artificial Neural Network for 28th day Compressive strength of Lateritic blocks

Experiment No	**Mix ratios (w/c:cement:laterite)**	**Compressive strength f_{cu}(N/mm^2)**
1	0.40:1:4	3.0600
2	0.46:1:5	2.9000
3	0.50:1:6	2.8400
4	0.63:1:7	2.6404
5	0.70:1:8	2.5100
6	0.74:1:9	2.4776
7	0.86:1:10	2.2140
8	0.88:1:11	2.0866
9	1.0:1:12	1.8422

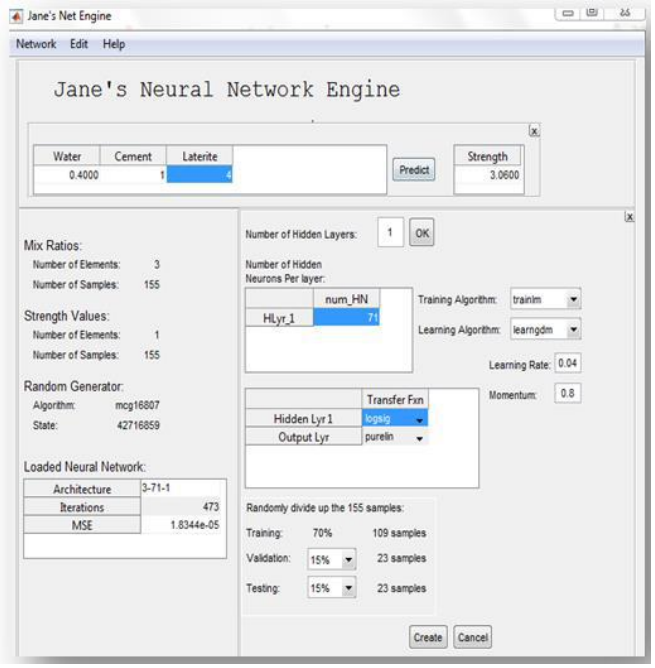

Fig 1: Training window showing predicted result from Artificial Neural Network Model for compressive strength of lateritic blocks.

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Table 4: Fisher test computations for Artificial Neural Network Compressive Strength Model

Exp. No	Mix ratios (w/c:cement:laterite)	$Y_{observed}$ (Y_O)	$Y_{predicted}$ (Y_P)	$Y_O - y_O$	$Y_P - y_P$	$(Y_O - y_O)^2$	$(Y_P - y_P)^2$
1	0.40:1:4	3.0600	3.0600	0.5511	0.5522	0.3037112	0.3049248
2	0.46:1:5	2.9000	2.9000	0.3911	0.3922	0.1529592	0.1538208
3	0.50:1:6	2.8400	2.8400	0.3311	0.3322	0.1096272	0.1103568
4	0.63:1:7	2.6400	2.6404	0.1311	0.1326	0.0171872	0.0175827
5	0.70:1:8	2.5100	2.5100	0.0011	0.0022	0.0000012	0.0000048
6	0.74:1:9	2.4800	2.4776	-0.0289	-0.0302	0.0008352	0.0009120
7	0.86:1:10	2.2100	2.2140	-0.2989	-0.2938	0.0893412	0.0863184
8	0.88:1:11	2.0900	2.0866	-0.4189	-0.4212	0.1754772	0.1774094
9	1.0:1:12	1.8500	1.8422	-0.6589	-0.6656	0.4341492	0.4430233
Σ		22.580	22.570			1.283288	1.294353
		y_O = 2.5089	y_P = 2.5078				

Legend: y = $\sum \frac{Y}{n}$

y = represents the response

n = the number of responses

Applying Eqn (1):

F=$\frac{{S_1}^2}{{S_2}^2}$(1)

$S_O^2 = \frac{1.283288}{8} = 0.160411$

$S_P^2 = \frac{1.294353}{8} = 0.161794$

F = $\frac{0.161794}{0.160411} = 1.008$

From F-table, $F_{0.95}(8, 8) = 3.5$

The calculated F is less than the F obtained from the table. Hence the model is adequate.

Table.5: Comparison of Artificial Neural Network Simulated Results with Experimental Result for Compressive Strength of Lateritic Block

Experiment No	Mix ratios (w/c: cement: laterite)	Experiment Result (E) (N/mm^2)	Neural Network Prediction (N) (N/mm^2)	Difference	Percentage difference (%)=$\left\|(E - N) \times \frac{100}{1}\right\|$
1	0.40:1:4	3.0600	3.0600	0.0000	0.0000
2	0.46:1:5	2.9000	2.9000	0.0000	0.0000
3	0.50:1:6	2.8400	2.8400	0.0000	0.0000
4	0.63:1:7	2.6400	2.6404	-0.0004	0.0151
5	0.70:1:8	2.5100	2.5100	0.0000	0.0000
6	0.74:1:9	2.4800	2.4776	0.0024	0.0968
7	0.86:1:10	2.2100	2.2140	-0.0040	0.1806
8	0.88:1:11	2.0900	2.0866	0.0034	0.1629
9	1.0:1:12	1.8500	1.8422	0.0078	0.4234

IV. CONCLUSION

In conclusion, compressive strengths were obtained experimentally from various mix ratios for the lateritic blocks. The maximum values for the 28th, 14th and 7th day are 3.06 N/mm^2, 1.91 N/mm^2 and 1.43 N/mm^2 respectively. The 28th day compressive strength was used to develop the Artificial Neural Network model. The highest and lowest Artificial Neural Network value for compressive strength is 3.0600 N/mm^2 and 1.8422 N/mm^2 respectively. The adequacy of the Artificial Neural Network model was tested using Fishers test. From the Fishers test, the value of 'F' from calculation is 1.008 while the allowable 'F' from table is 3.5. The model is adequate since the calculated value was less than the value obtained

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from the "F" table. Percentage difference were obtained from the comparison of Artificial Neural Network model result with experimental result. The maximum percentage difference was 0.4234 % as shown in Table 5.

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Influence of Different Levels of Adsorbent "Vitacorm Reo-M" on the Morphological and Biochemical Blood Parameters of the Gilts

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***Abstract*—** *The study was carried out to determine the effects of levels of adsorbent "Vitacorm REO-M" on the growth, hematology, and serum biochemistry of pigs. The pigs were separated into four groups and further randomized design and fed diets contained by weight: concentrates grain mixture consisting of barley – 43.0%, corn – 10.0%, wheat – 11.0 – 11.5%, peas – 8.0 – 8.5%, and also bran – 6.0-8.0%, soybean meal – 5.0-9.0%, sunflower meal – 6.0%, fish meal – 5.0%, soybean oil – 2.0%, premix – 2.5%. The control animals (CG) were fed the main diet and EG_1, EG_2 and EG3 diet included adsorbent additive "Vitacorm REO-M" in the amount of 2.0, 4.0 and 6.0 kg per ton of feed, respectively. The pigs were adequately housed, while feed and potable water were supplied ad libitum. At the end of the experiment 3 pigs were randomly sampled from each treatment (1 per replicate) and blood collected through venipuncture on veins at backside of the ears. Results showed significant ($P \leq 0.05$) effect of "Vitacorm REO-M" at a dosage of 4 kg per ton of feed allowed to obtain an additional average daily gain in EG_2 (0.541 kg) 7.98% higher than in the CG. Was found that the highest content of total protein at the end of the experience was observed in CG - 68.95% (while in EG_2 - 64.43%, EG_1 - 64.62%, EG_3 - 63.22%) and the highest level of γ-globulin content was noted in EG_1 and EG_3, respectively 9.33 and 9.53%. AST activity maximum increase (at a rate of 22.0-47.0 u/l) was observed in animals of the EG_1 by 11.11%, and a decrease of 7.02% in EG_3 relative to the CG. In the EG_2, the AST index was within the normal range - 40.0 U/l. ALT activity was reduced in comparison with the CG in the EG_1 by 4.23% - 3.0 U/l, in the EG_2 - by 19.72% - 14.0 U/l.*

Keywords*— *adsorbent, blood parameters, growth performance, pigs.

I. INTRODUCTION

Mycotoxins are toxic metabolites produced by several fungi species, with the aflatoxins, fumonisins, zearalenone, trichothecenes and ochratoxin A being the most important found in feedstuffs. The contamination of feed with mycotoxins is a continuing feed safety issue leading to economic losses in animal production [1]. The economic impact of mycotoxins includes mortality of domestic animals, increased costs due to veterinary care and decreased production efficiency, especially in poultry and swine operations [2]. Mycotoxin control is essential for health and performance, as mycotoxins contaminate almost all agricultural ingredients. A mycotoxin survey on different feedstuffs in specific areas allows the correct implementation of cost-effective control programs. Reducing the bioavailability of mycotoxins is aimed at reducing toxic effects due to the inclusion of toxic pollutants in various binders or sorbents. This approach allows preventing the harmful effects of various mycotoxins on animal organisms (primarily poultry and pigs) by reducing the degree of absorption and subsequent distribution by blood. Detoxification methods should also be affordable and easy to use. The optimal solution to the mycotoxicosis problem is the use of supplements in diets that, when introduced into feed, become active against mycotoxins directly in the animal's body. Practical methods to detoxify mycotoxin contaminated grain on a large scale and in a cost-effective manner are not currently available. A current approach is to add non-nutritive feed additives, such as sorptive materials, to the diet in order to reduce the absorption of mycotoxins in the gastrointestinal tract [3, 4].

II. MATERIAL AND METHODS

2.1. Experimental design, animals and diets

The experimental part of the research was implemented by conducting scientific and business experience, accompanied by a series of laboratory analyzes. In the scientific and business experience in the conditions of the State Enterprise for the Selection and Hybridization of Pigs "Moldsuingibrid" Orhei District), the effectiveness of the use of the adsorbent additive Vitacorm REO-M in the compound feeds of young pigs was studied. Experimental design, animals and diets 150-day study with a total of 40 crossbred pigs [the same genotype] with an initial body weight (BW) of 17.8-17.9kg were

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randomly assigned to 4 dietary treatments (10 pigs in each) for in vivo experiments.

The feeding and caring conditions of the experimental pigs were the same; they were fed compound feeds prepared from local feeds in accordance with detailed feeding norms [10]. The basal diet contained by weight: concentrates: grain mixture consisting of barley – 43.0%, corn – 10.0%, wheat – 11.0-11.5%, peas – 8.0-8.5%, and also bran – 6.0-8.0%, soybean meal – 5.0-9.0%, sunflower meal – 6.0%, fish meal – 5.0%, soybean oil – 2.0%, premix – 2.5%. The control animals were fed the main diet without the addition of the adsorbent. The composition of feed for EG_1, EG_2 and EG_3 included adsorbent additive "Vitacorm REO-M" in the amount of 2.0, 4.0 and 6.0kg per ton of feed, respectively. The tested preparations of adsorbents in the composition of these feeds were injected using standard dispensers, which contributed to their more uniform mixing with other ingredients.

The main task of the scientific research was to identify the most effective levels of adsorbent injection and their effect on the hematological parameters of growing pigs, as well as the development of new ways to increase the efficiency of the use of mycotoxin-adsorbing supplements.

The experiment used the adsorbent "Vitacorm REO-M" - feed additive-sorbent-re-modifier used for the prevention of toxicosis in farm animals and poultry when feeding feeds affected by mycotoxins, as well as in order to obtain environmentally friendly products. "Vitacorm REO-M" contains extruded wheat seeding - 10%, bentonite - 25%, vermiculite - 25%, palygorskite clay - 30%, acidifier at least - 5%, yeast autolysate - 5%, which normalizes metabolism, improves feed conversion.

At the beginning of the experiments and at the end of each period, the animals were weighed in order to study the dynamics of general and average daily gains. The absolute increase in live weight by periods of cultivation is calculated by the formula:

$A = Wt - W_0$, where:

A - the absolute increase in live weight for the analyzed period, kg;

W_0 - live weight at the beginning of the period, kg;

Wt - live weight at the end of the period, kg.

Average daily gain in live weight was determined by the formula: $Ac = (W_к - W_н) / t$, where:

Ac - the absolute average daily increase in live weight, g;

Wn - the initial mass;

Wc - the final mass;

t - the time period between measurements.

2.2. Experimental design, animals and diets

To determine the intensity of metabolic processes in the body of the experimental pigs, hematological studies were performed. Blood for analysis and for biochemical studies was taken at the beginning and at the end of each experiment, in the morning before feeding from the ear vein (at the same time) from three heads of analogues from each group with subsequent stabilization with heparin [10].

In the serum of animals there were determined the main morphological indicators, as well as the content of total protein and its fractions, total calcium and inorganic phosphorus, alkaline phosphatase activity, aspartate-alanine aminotransferase (AsAT and AlAT), etc. Morphological and biochemical blood tests were conducted at the Republican Diagnostic Center in Chisinau.

The economic efficiency of using the studied adsorbents in the diets of the experimental pigs was calculated taking into account the definition of costs with the calculation of the level of profitability [11].

All data were subjected to statistical analyses as a randomized complete block design using the Excel software. Differences among treatment means were determined using Turkey's multiple range tests.

Table.1: The indicators of body weight of the pigs during the period of experiment, kg ($\overline{X} \pm S\overline{x}$)

Indicators	**CG**	**EG_1**	**EG_2**	**EG_3**
At the beginning of the preparatory stage of the experiment	17.9 ± 0.169	17.8 ± 0.189	17.8 ± 0.155	17.9 ± 0.145
At the beginning of the experiment	18.7 ± 0.174	18.5 ± 0.206	18.6 ± 0.176	18.8 ± 0.148
At the end of the I stage of the experiment	29.8 ± 0.588	29.7 ± 0.206	31.0 ± 0.533	30.8 ± 0.654
At the end of the II stage of the experiment	42.3± 1.57	44.5± 1.81	46.1± 1.19*	45.9 ± 0.68*
At the end of the experiment	94.3± 1.96	96.6± 2.38	100.0±1.32**	96.7± 1.72
- in % compared to the control	100.00	102.49	106.31	102.51
The increase in body weight for the experiment:				
- absolute, kg	75.6±1.86	78.1±2.32	81.6±1.36	77.8±1.69
- in % compared to the control	100.00	103.32	107.94	102.92
***p≤0.1; **p≤0.05**				

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III. RESULTS AND DISSCUSSION

3.1. Growth performance and blood analyses

In general, during the experience, the best indicators in live weight were obtained in EG_2, in pigs that received 4 kg of the adsorbent additive "Vitacorm REO-M" per ton of feed; the animals in this group reached a mass of 100.28kg, which is 6.31% more, than in CG (94.33kg). In the other two experimental groups, a higher growth in live weight in EG_1 - 96.68kg was also observed, which is higher compared to the control group by 2.49%, and in EG_3 - 96.7kg, which is 2.51% more, respectively. The indicators of animal productivity over the study period are presented in Table **Error! Not a valid bookmark self-reference.**.

Table.2: Average daily gain of pigs by stages of experiment, kg ($\overline{X} \pm S\overline{x}$)

Stages of the experience	CG	EG_1	EG_2	EG_3
At the preparatory stage of the experiment	0.089±0.003	0.080±0.004	0.090±0.006	0.094±0.003
At the I stage of the experiment	0.409±0.026	0.448±0.030	0.475±0.020*	0.466±0.011*
At the II stage of the experiment	0.559±0.017	0.562±0.021	0.582±0,019	0.547±0.021
The whole experiment	0.501±0.012	0.518±0.015	0.541±0.009**	0.516±0.011

* $p \leq 0.1$; ** $p \leq 0.05$

Adsorbent additive "Vitacorm REO-M" at a dosage of 4 kg per ton of feed allowed to obtain an additional average daily gain in EG_2 (0.541 kg) 7.98% higher than in the CG, this indicator was the best both in growing periods and in general for the experience. The pigs from EG_1 and EG_3 showed an average daily gain of 0.518 and 0.516 kg, respectively, which is 3.39 and 2.99% higher than in the CG.

The blood indices of the experimental pigs were studied in order to study the effect of different input levels of the adsorbent additive Vitacorm PEO-M on the body of the pigs. At the beginning (06.06.2012) and at the end (05.11.2012) of the experiment, blood samples were taken for subsequent analysis of the biochemical and morphological parameters in the laboratory. Blood samples for analysis were taken from three pigs from each group (Figure 1).

Fig. 1. Blood sampling

The analysis of the hematological profile parameters showed that according to the results obtained after statistical processing of the data on the number of erythrocytes, hemoglobin, leukocytes, total protein in the blood, as well as the content of calcium, phosphorus and protein fractions in blood serum, the physiological reactivity of the animals in all groups at the beginning of the experience was the same. One of the most important cellular elements of the blood are red blood cells, which are spongy little bodies, whose small pores are filled with hemoglobin, the very substance that helps red blood cells to perform the function of transporting gases. Red blood cells make up the bulk of the blood cells. In our study, the number of erythrocytes in the animals of all experimental groups naturally increased and was higher than in the control group by 1.33-3.19% (figure 2).

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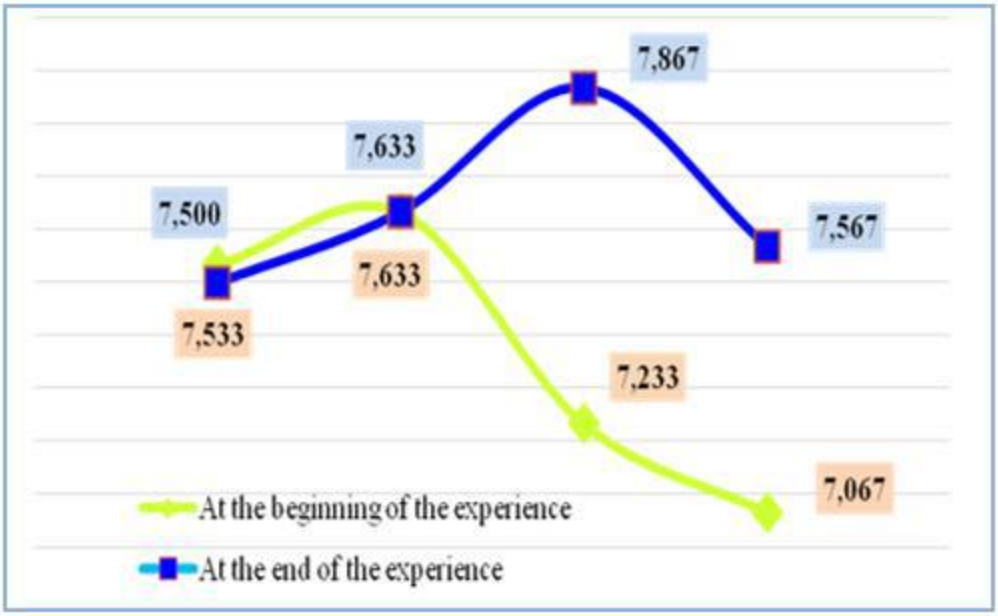

Fig. 2. The content of red blood cells in pigs, 10^{12}/l

It is known that with age in the blood of animals there is a tendency of increasing the number of erythrocytes and leukocytes, while reducing the hemoglobin content, reducing the color index, but the number of blood platelets remains almost unchanged. Consequently, hemoleukopoesis in 6-7-month-old animals slightly increases, which can be associated with high growth energy of the individuals of this age. The number of leukocytes in the experimental groups EG_1, EG_2 and EG_3 under the influence of the adsorbent inclusion was higher in comparison with the control animals by 0.660, 0.133 and 2.77*10^9/l, respectively (Table 3), which indirectly characterizes the degree of resistance of the body.

Even greater differences in data are found for hemoglobin. The hemoglobin content in pigs is 100-120 grams per liter of blood. In the experiment it was better expressed in the control group, the gilts of the first experimental group were inferior to them by 8.33g/l ($p \leq 0.05$). For a more significant amount in favor of the control group, the data differed in pigs of the second group, in whose blood the hemoglobin content was 11.33g/l lower ($p \leq 0.1$) (Table 3). The hemoglobin in the blood is a protein that participates in the process of transporting oxygen from the lungs to the tissues and organs of the body. In the capillaries of the lungs, oxygen combines with hemoglobin and, along with the blood stream, spreads through the body, along the way getting rid of the compound with protein and joining other substances. At the same time, carbon dioxide is added to the hemoglobin, which must be removed from the tissues.

Table.IV: The morphological parameters of the blood of the pigs at the end of experiment, $\overline{X} \pm S\overline{x}$

Hemoglobin, g/l	**129.33±1.453**	**121.00±1.000****	**118.00±3.606***	**121.33±5.783**
Leukocytes, 10^9/l	21.13±2.085	21.79±0.806	21.26±2.326	23.90±1.100
Color indicator, units	0.497±0.009	0.500±0.021	0.470±0.010	0.503±0.012
Lymphocytes, 10^9/l	58.33±6.766	67.67±4.667	71.33±4.667	57.00±4.583

* $p \leq 0.1$; **$p \leq 0.05$

The most important components of blood are also nitrogenous compounds, where the proteins take the most important part in the metabolism [12]. Blood serum proteins are divided into several fractions according to a number of physiological functions. They play an important role in the body's defensive activity, water metabolism, transportation of nutrients, metabolic products, and blood coagulation. Proteins are the most important biologically active substances, and their level in the blood to a certain extent determines the indicator of the intensity of protein metabolism in the body [13, 14].

Unspecified dynamics of the protein spectrum is noted in the blood of the pigs when using the additives of an adsorbent preparation.

According to the results of the obtained analyzes, we have found that the total protein content in the blood of the experimental pigs of all groups at the end of the experience was significantly higher than at the beginning

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of the experience. Moreover, the highest content of total protein at the end of the experience was observed in CG - 68.95%, while in EG_2 - 64.43%, EG_1 - 64.62%, EG_3 - 63.22% (Table 4). The revealed changes in the protein spectrum of the young pigs from the experimental groups are associated with age-related features, intensive protein metabolism, which ensures enhanced growth of their body, which is confirmed by higher average daily gains of the piglets [15].

Table.4: The content of protein and its fractions in the blood of pigs at the beginning and at the end of the experiment, $\overline{X} \pm S\overline{x}$

Indicators	Groups			
	CG	EG_1	EG_2	EG_3
At the beginning of the experiment				
Total protein, g/l	48.58±3.239	45.98±8.660	48.73±1.681	53.50±1.202
Albumins, g/l	29.29±2.829	30.22±1.896	26.37±3.439	27.12±2.264
Albumins, %	34.80±3.121	34.23±6.293	37.73±5.716	37.67±2.972
α_1-globulins, %	10.10±4.245	4.20±0.781	4.24±0.504	4.20±0.200
α_2-globulins, %	31.63±2.842	26.60±4.951	36.83±4.043	34.30±1.557
β_1-globulins, %	12.37±2.095	23.40±10.982	12.53±0.418	13.30±0.700
γ-globulins, %	11.10±0.833	11.57±1.384	8.67±1.746	10.53±0.797
A / G - coefficient	0.54±0.076	0.55±0.141	0.63±0.139	0.61±0.074
At the end of the experiment				
Total protein, g/l	68.95±1.133	64.62±0.518**	64.43±1.494*	63.22±0.747**
Albumins, g/l	33.63±0.412	32.18±0.181*	32.92±1.109	32.10±2.987
Albumins, %	38.33±0.657	37.50±2.255	40.43±1.517	39.10±0.755
α_1-globulins, %	2.50±0.265	2.47±0.033	2.30±0.100	2.60±0.100
α_2-globulins, %	22.37±1.576	22.60±0.416	23.73±1.087	23.14±1.017
β_1-globulins, %	17.47±0.481	18.50±0.700	17.67±1.157	16.03±1.267
β_2-globulins, %	10.53±1.691	9.60±0.656	7.97±1.071	9.60±0.656
γ-globulins, %	8.80±0.709	9.33±1.084	7.90±0.611	9.53±1.068
A / G - coefficient	0.62±0.019	0.60±0.057	0.68±0.046	0.64±0.022

Our data conform to the results of other researchers who report that a lower total protein content in the blood of animals is due to more intensive processes of protein metabolism in their bodies with high growth energy [16, 17].

The state of the natural resistance of animals is studied according to the main indicators of cellular and humoral protection factors - phagocytic, bactericidal, lysozyme activity and serum gamma globulin levels [18, 19, 20, 21].

There is a number of biochemical blood parameters by which one can judge the general condition of the body and the level of metabolic processes in it. Proteins are vital components of plasma. Thus, albumin plays an important role in maintaining osmotic pressure, transport of calcium, tryptophan, bilirubin, bile salts. Alpha and beta globulins transport hormones (thyroxin, insulin), as well as iron and some vitamins. Gamma globulins are involved in the immune response.

An important plastic material which is used as an energy source, if necessary, are albumins, which, forming complexes with toxic substances, neutralize them. Albumin is one of the protein fractions, a decrease in the level of which may indicate liver damage and the presence of infectious processes in the body. According to the results of our biochemical tests, the albumin index in the three groups was within the physiological norm (23-40 g / l) [22]: in the control group - 33.63 g / l, in EG_1 - 32.18 g / l, in EG_2 - 32.92 g / l and in EG_3 - 32.10 g / l (Table 4).

Proteins of globulin fractions, in particular α- and β-globulins, are actively involved in maintaining the osmotic pressure of the blood. In addition, β - globulins actively exhibit protective properties. The immune properties of γ-globulins are most strongly manifested, since they contain antibodies to the causative agents of various infectious diseases and are the main carriers of antibodies in the body. In the experiment, the highest level of γ-globulin content was noted in EG_1 and EG_3, respectively, 9.33 and 9.53% (Figure 3).

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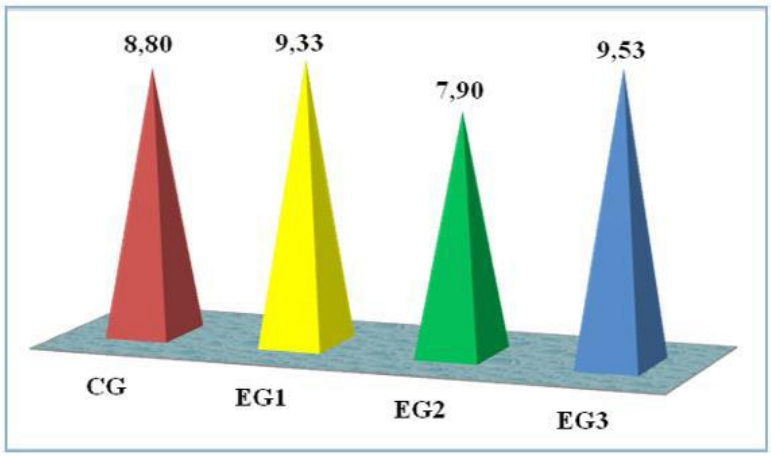

Fig. IV. The content of γ-globulin in the blood of pigs at the end of the experiment, %

Metabolism consists of a combination of many chemical reactions that occur in the body. The course of these reactions is carried out with the help of biological catalysts-enzymes, one of which is the class of transferases, which catalyze the hydrolytic cleavage of intramolecular bonds.

An increase in the activity of aspartate aminotransferase (AST) (a key enzyme for the metabolism of nitrogenous substances) and alaninaminotranspherase (ALT) (an enzyme characterizing the use of amino acids in the process of gluconeogenesis) in serum is observed in diseases associated with cell destruction, liver diseases, renal necrosis.

In our studies, the maximum increase in AST activity (at a rate of 22.0-47.0 u / l) was observed in animals of the first experimental group by 11.11%, and a decrease of 7.02% in the third experimental group relative to the control group. In the second experimental group, the AST index was within the normal range - 40.0 u / l. ALT activity was reduced in comparison with the control group in the first experimental group by 4.23% - 3.0 units / l, in the second experimental group - by 19.72% - 14.0 units / l (Figure 4).

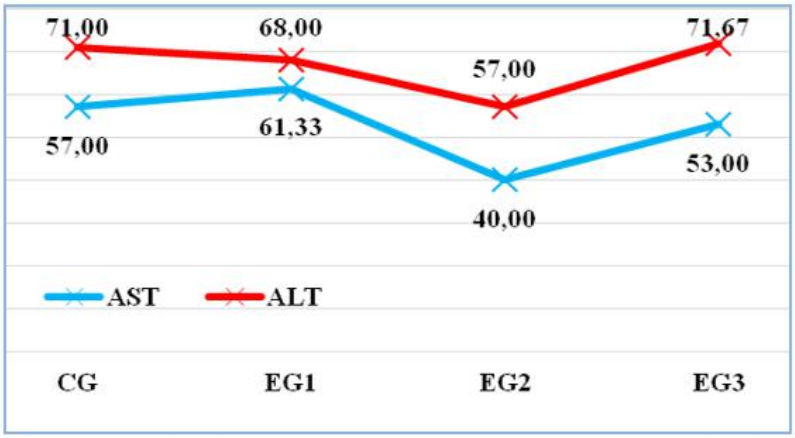

Fig. 4. AST and ALT content in the blood of pigs at the end at the experiment, U/l

The introduction of different doses of the adsorbent to the basic ration did not have a significant effect on the mineral composition of blood in comparison with the control group. A slight decrease in the blood content of piglets from the experimental groups of calcium and phosphorus indicates the presence of hidden processes in the body, associated with exposure to external conditions — insufficient ventilation and high air temperature, low bioavailability of feed nutrients, etc.

In general, all blood parameters of the experimental animals did not exceed the physiological norms. This suggests that the adsorbent additive "Vitacorm REO-M" does not have an allergic or other negative effect on the animal's body and especially it helps to improve the mineral metabolism in it. Consequently, judging by the results of blood tests of the experimental animals, the studied doses of adsorbents in the composition of their diets do not reduce the level of internal constancy of the body.

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IV. CONCLUSION

Hematological tests belong to important laboratory diagnostic methods. Blood composition and proportion of the components are important indicators of health and functional status of the organism. Adsorbent additive "Vitacorm REO-M" at a dosage of 4 kg per ton of feed allowed to obtain an additional average daily gain in EG_2 (0.541 kg) 7.98% higher than in the CG.

The number of erythrocytes in the animals of all experimental groups naturally increased and was higher than in the control group by 1.33-3.19%. The number of leukocytes in the experimental groups EG_1, EG_2 and EG_3 under the influence of the adsorbent inclusion was higher in comparison with the control animals by 0.660, 0.133 and 2.77 10^9/l, respectively.

Was found that the total protein content in the blood of the experimental pigs of all groups at the end of the experience was significantly higher than at the beginning of the experience. Moreover, the highest content of total protein at the end of the experience was observed in CG - 68.95%, while in EG_2 - 64.43%, EG_1 - 64.62%, EG_3 - 63.22% and the highest level of γ-globulin content was noted in EG_1 and EG_3, respectively, 9.33 and 9.53%.

AST activity maximum increase (at a rate of 22.0-47.0 u/l) was observed in animals of the first experimental group by 11.11%, and a decrease of 7.02% in the third experimental group relative to the control group. In the second experimental group, the AST index was within the normal range - 40.0 u/l. ALT activity was reduced in comparison with the control group in the first experimental group by 4.23% - 3.0 units / l, in the second experimental group - by 19.72% - 14.0 u/l.

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A New Under-Frequency Load Shedding Method Using the Voltage Electrical Distance and Artificial Neural Networks

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Abstract*—This paper proposes a method for determining location to shed the load in order to recover the frequency back to the allowable range. Prioritize distribution of the load shedding at load bus positions based on the voltage electrical distance between the outage generator and the loads. The nearer the load bus from the outage generator is, the sooner the load bus will shed and vice versa. Finally, by selecting the rate of change of generation active power, rate of change of active power of load, rate of change of frequency, rate of change of branches active power and rate of change of voltage in the system as the input to an Artificial Neural Network, the generators outage, the load shedding bus are determined in a short period of time to maintain the stability of the system. With this technique, a large amount of load shedding could be avoided, hence, saved from economic losses. The effectiveness of the proposed method tested on the IEEE 39 Bus New England has demonstrated the effectiveness of this method.*

Keywords*—load shedding, Voltage Electrical Distance, Artificial Neural Network, under-frequency load shedding.

I. INTRODUCTION

The imbalance active power between the generation and the load demand causes a decrease the frequency in the power system. When the balance with the active power occurs, it'll give the serious for the frequency instability of the system. The methods such as primary frequency control, secondary frequency control, reserve power of the generation units in the system are only effectiveness when the system is slightly overloaded and the frequency of the system is less decrease. But in cases of serious power imbalance and lead to the blackout completely, the system need be used load shedding program to recovery the frequency.

Jianfeng and et al [1] have developed a method with risk indicators to determine the bus should be targeted for load shedding to maintain stable voltages. Buses with the highest voltages risk are prioritized for load shedding. This is estimated from the probability of the collapse of the voltage occurring. Risk indicators are the products of these probabilities and the effects of voltage collapse.

In [2], Hsu and et al presented a strategy of load shedding by performing artificial neural network (ANN) and transient stability analysis for an electrical system. To prepare the training data for ANN, transient stability analysis of a real power system has been made to address the minimized load with different operating scenarios. The Levenberg-Marquardt algorithm was combined with the back propagation algorithm for neural network training. By choosing the total generating capacity, total load demand and decay frequency are neural inputs of ANN, the output is the minimum number of load shedding that are identified to maintain the stability of the power system.

In the paper [3], a new approach based on hybrid Particle Swarm-Based-Simulated Annealing Optimization technique (PSO-B-SA) is proposed for solving under-voltage load shedding (UVLS) problem. Under voltage load shedding (UVLS) is one of the most important tools for avoiding voltage instability. In this paper, the UVLS problem is formulated based on the concept of the static voltage stability margin and its sensitivity at the maximum loading point or the collapse point. The voltage stability criterion is modeled

directly into the load-shedding scheme. In any UVLS scheme finding the global point is very important for having cost effective economy. The proposed PSO-B-SA methodology is implemented in the under voltage load shedding scheme for IEEE 14 and 118 bus test systems. Simulation

results show the efficacy and advantage of the proposed scheme.

A good load shedding program must shed the minimum number of loads as quickly as possible, it also meets all technical constraints to ensure a stable system. Conventional load shedding techniques are limited by

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load shedding overloading required and slow performance. Intelligent load shedding methods have also been studied and developed such as genetic algorithm (GA) [4] and particle swarm optimization (PSO) algorithm [5]. These
focus on determining when and how much load should be disconnected. Studies on the location of load shedding are very limited.

This paper proposed the method of load shedding based on voltage electrical distance method and neural networks. ANN is used to identify and classify load shedding control strategies based on the designed rules. The effectiveness of the proposed method has been tested on the IEEE 39 Bus New England.

II. THE VOLTAGE ELECTRICAL DISTANCE

The voltage electrical distance between the two nodes i and j is the following formula [6]:

$$D_{(i,j)} = D_{(j,i)} = -\mathrm{Log}(\alpha_{ij} * \alpha_{ji}) \quad (1)$$

Where: $a_{ij} = \dfrac{\delta V_i / \delta Q_j}{\delta V_j / \delta Q_j}$, $a_{ji} = \dfrac{\delta V_j / \delta Q_i}{\delta V_i / \delta Q_i}$ (2)

$\dfrac{\delta V_i}{\delta Q_j}$, $\dfrac{\delta V_j}{\delta Q_j}$, $\dfrac{\delta V_j}{\delta Q_i}$, $\dfrac{\delta V_i}{\delta Q_i}$ are components extracted from the inverse matrix of the Jacobian matrix.

The formula $\Delta V_i = \alpha_{ij} * \Delta V_j$ [6] represents the voltage drop at node i when disturbance occurs at node j. From formula (1), the distance near found, relative with $D_{(i,j)}$ small or α_{ij} as large. On the other hand, the larger the α_{ij}, the lower the voltage drop at node i when the disturbance at j as large. Thus, when the generator outage, the voltage fluctuation range near the fault node is large, resulting in the voltage drop at near nodes also increases, then load shedding will be at the nearest distance load buses or the largest voltage drop.

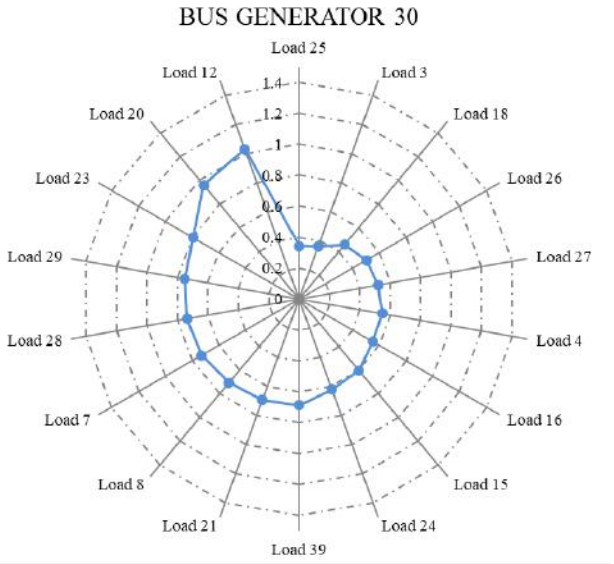

Fig. 1: The block diagram of the relationship between the generator k and the loads

With: $D_V(k,1) < D_V(k,2) < D_V(k,3) < \ldots < D_V(k,n)$

Prioritized load shedding: Load 1 → Load 2 → Load 3 → … → Load n

III. PROPOSED METHODS

3.1. Set up load shedding program

Load shedding program are based on three main factors: the timing, the amount of load to be shed and the location of load shedding.

The timing: The system data is sent to the control center for continuous measurement, when the system frequency is within the allowable range of 59.7Hz<f, the load shedding program will start, the neuron function will be activated to identify the generator outage and the load shedding sequence. The operating time of the UFLS relay is about 0.1s [7] after the frequency falls below the allowable threshold and the process is carried out until the recovery frequency reaches the allowable value. In some emergency cases, (short circuit, loss of generator) this method cannot maintain system stability or restore the frequency with quite long time. Using smart computing technology, the proposed effective load shedding intervals require less than 500ms [8]. Here, the proposed load shedding period is 200ms. This time period includes: measurement of data acquisition, data transfer, data processing and tripping trip. However, to ensure safe margin in real time as well as allowable errors, a period of 100ms [9] is added. So, in the simulation, here the proposed load shedding time is 300ms.

The amount of load to be shed: After obtaining the load shedding sequence list for each generator failure, use the offline PowerWorld simulation software to shed for each generator in trouble at different load levels from 80% to 100% full load. Dismissed until the frequency of the buses are within the allowable range of stopping, so that for each case the incident will have the number of load shedding corresponding to that case. The incident data collected would correspond to a number of load shedding from the trained neuron function.

Location of load shedding: Use voltage electrical distance for calculating distance between nodes. The load shedding position will be based on the distances from the generator outage (generator bus) to the remaining load buses to the load shedding order, or in other words the priority of the nodes closer to the generator will be first off, because these load nodes directly affect the generator is the most trouble. The flowchart load shedding process is shown in Fig. 2.

3.2. Application ANN to identify the load shedding

Due to the complexity of the power system, the above-mentioned traditional methods take a lot of time to clear up, thus causing delays in decision making, The ANN method is used to solve difficult problems that traditional methods do not solve in terms of speed and performance.

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However, ANN needs to be trained on the basis of initial data. Therefore, it is necessary to build the set to leran, including various outages. Data samples representing in each outage are the change in generator power ΔP_G, the change of frequency in buses Δf_{bus}, the voltage drop of buses ΔV_{bus}, the change of load ΔP_{load} and the change of power distribution across the transmission lines ΔP_{branch}. During the simulation, various load levels were considered to cover the operating modes.

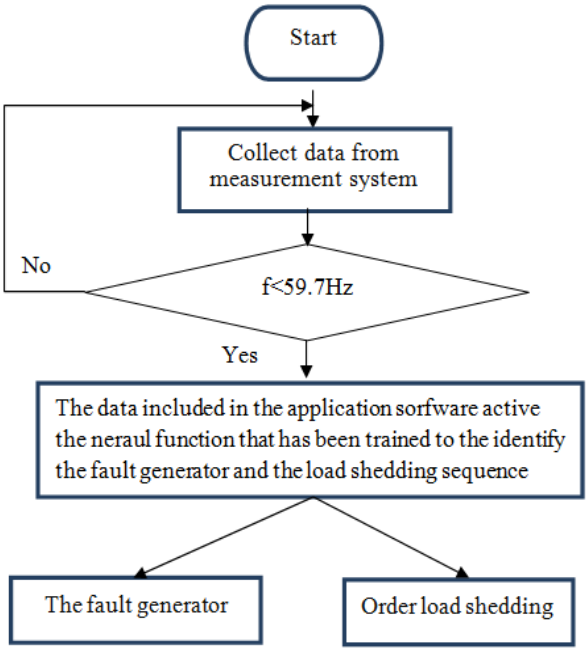

Fig. 2: Flowchart load shedding online

During the ANN model identification process, the creation database of the generator outage is considered the most important. Reliable databases not only determine the accuracy of the assessment, but also have a significant impact on the robustness of the model.

There are two elements that need to be clearly demonstrated during the simulation:

- The database must cover the operational status and must adequately represent the various incident scenarios.
- The generated database must ensure the objectivity of the parameters of the test power system.

The process of creating a database based on simulation PowerWorld and it is done through the following 5 stages:

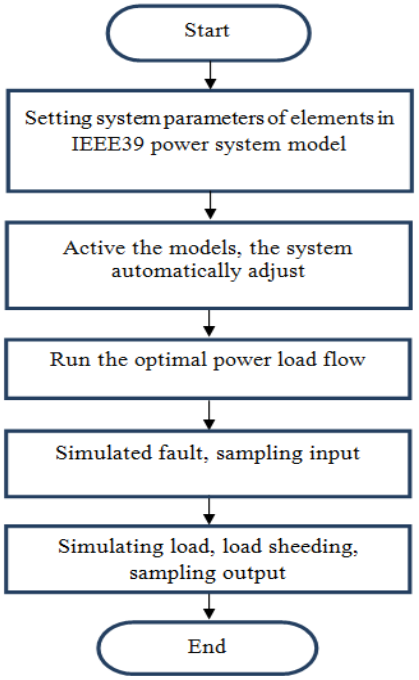

Fig. 3: Simulation steps for input, output sampling

The process of creating input database set is shown in Fig. 4.

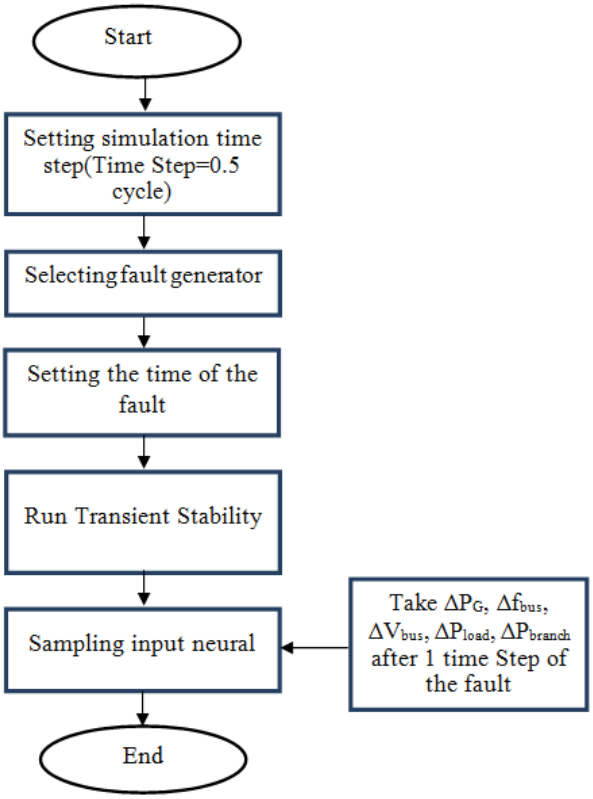

Fig. 4: The process of creating input database set

The process of creating output database set is shown in Fig 5.

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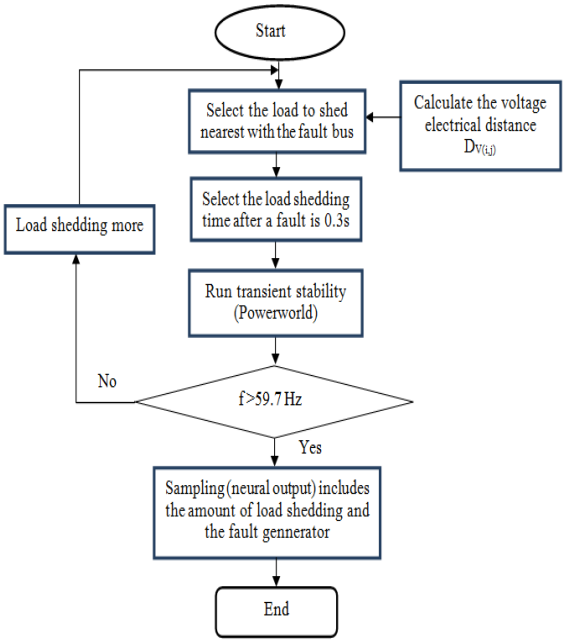

Fig. 5: The process of creating output database set

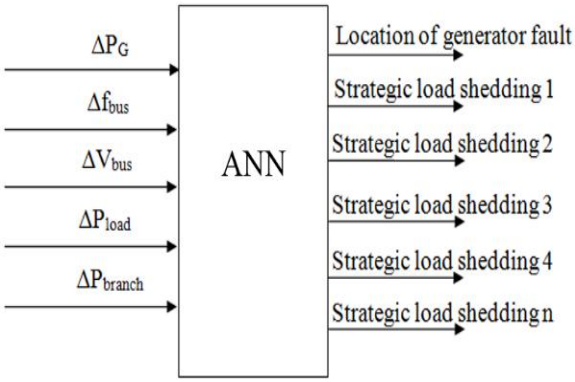

Fig. 6: Neural network training model with inputs and outputs

IV. TESTING ON THE IEEE 39 BUS NEW ENGLAND

The proposed method is tested on The IEEE 39 bus New England, using Power world software to collect samples and Matlab software for neural network training.

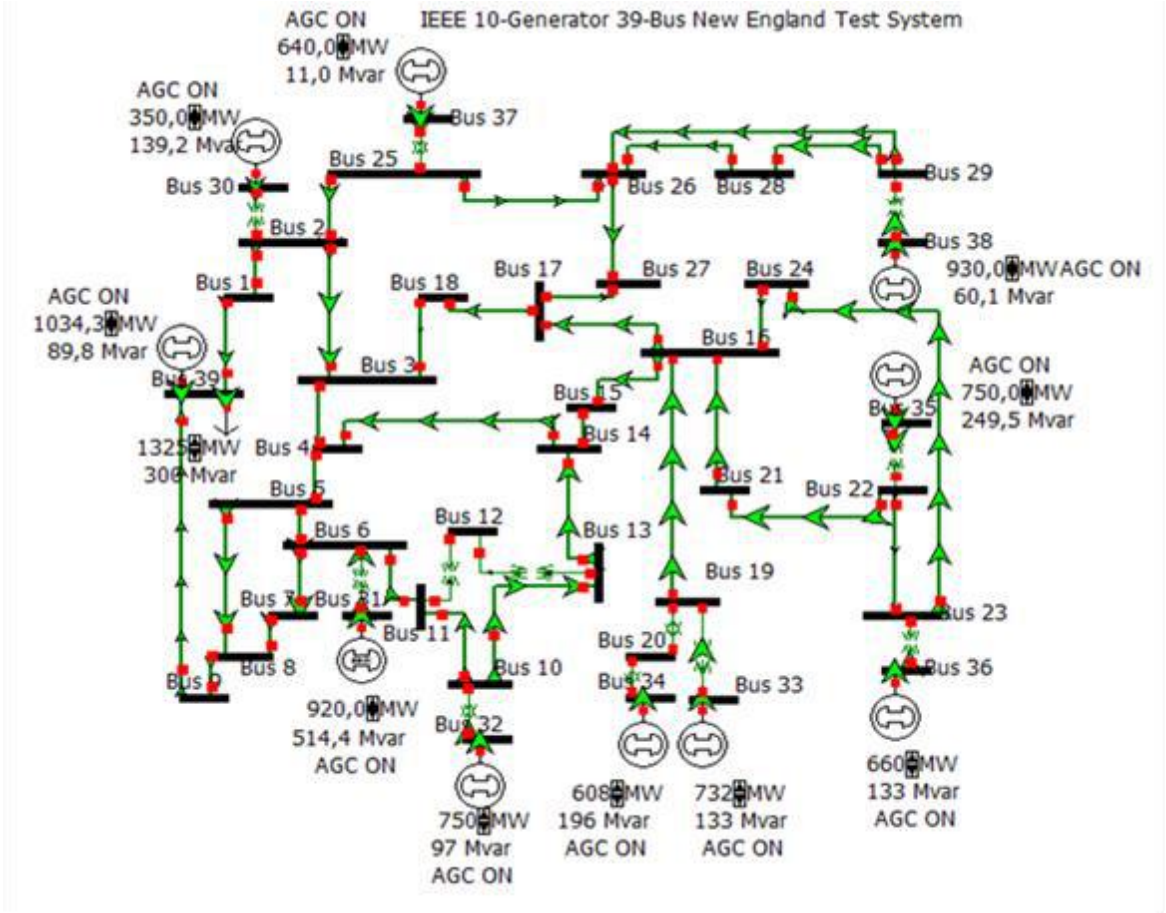

Fig. 7: The IEEE 39 bus New England

4.1. Load shedding program the neural network

The process created a load shedding program use the neural network shown in Fig. 8.

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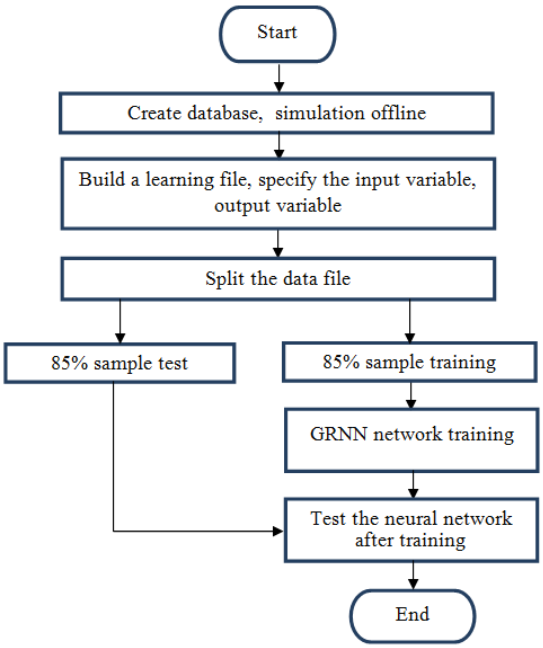

Fig. 8: Flowchart simulator sampling and neural network training

4.2. Creating database set

Data is available when each generator outage occurs at different load levels (80% to 100%). This process is done by off-line simulation using PowerWorld software.

Parameters representing in each case of generator faults are the change of generator power (ΔP_G), the change of frequency at the bus (Δf_{bus}s), the voltage drop at the bus (ΔV_{bus}), the change in load capacity (ΔP_{load}) and the change in power distribution across transmission lines (ΔP_{branch}).

4.3. Calculate the Voltage Electrical Distance

Voltage electrical distance is physical relationship between two buses in power system. Voltage electrical distance can be obtained by following step.

Step 1: Turning all PV generator buses into PQ load buses.

Step 2: From the matrix Jacobian J, have a matrix J4 from Powerworld, in which $J4 = [\partial Q/\partial V]$ (3)

Step 3: Inverse J4, call $B = J4^{-1}$. Each element of matrix B is written:

$$b_{ij} = [\frac{\partial V_i}{\partial Q_i}] \quad (4)$$

Step 4: Take the α_{ij} decrease matrix, between nodes i and j, as follows:

$$a_{ij} = \frac{b_{ij}}{b_{jj}} \quad (5)$$

$$a_{ji} = \frac{b_{ij}}{b_{ii}} \quad (6)$$

Step 5: Calculate the voltage electrical distance between nodes i and j calculated according to the formula (1):

$$D_{ij} = D_{ji} = -\log(\alpha_{ij} \times \alpha_{ji})$$

After completing step 5, we obtain table 1

Table.1: Table voltage electrical distance between the generator buses and the load buses.

	Bus 30	**Bus 32**	**Bus 33**	**Bus 34**	**Bus 35**	**Bus 36**	**Bus 37**	**Bus 38**	**Bus 39**
Bus 3	0.2713	0.6145	0.5104	0.6583	0.4860	0.5908	0.3627	0.5117	0.4162
Bus 4	0.4117	0.4983	0.5665	0.7144	0.5421	0.6469	0.4949	0.6263	0.4479
Bus 7	0.5514	0.5471	0.7253	0.8732	0.7009	0.8057	0.6386	0.7783	0.4446
Bus 8	0.5339	0.5491	0.7153	0.8631	0.6909	0.7957	0.6221	0.7643	0.4053
Bus 12	0.7925	0.6192	0.9137	1.0615	0.8893	0.9940	0.8725	0.9968	0.7824
Bus 15	0.4517	0.6132	0.4053	0.5531	0.3809	0.4856	0.5106	0.5905	0.5427
Bus 16	0.4124	0.6393	0.3183	0.4662	0.2939	0.3987	0.4651	0.5323	0.5243
Bus 18	0.3432	0.6505	0.4561	0.6039	0.4317	0.5364	0.4074	0.4983	0.4790
Bus 20	0.7244	0.9513	0.2636	0.1542	0.6059	0.7107	0.7771	0.8443	0.8363
Bus 21	0.5188	0.7458	0.4248	0.5726	0.2317	0.3679	0.5716	0.6387	0.6308
Bus 23	0.5941	0.8210	0.5000	0.6479	0.2020	0.2170	0.6468	0.7140	0.7060
Bus 24	0.4657	0.6926	0.3716	0.5194	0.3064	0.3967	0.5184	0.5855	0.5776
Bus 25	0.2592	0.7422	0.6092	0.7571	0.5848	0.6896	0.1742	0.4549	0.4567
Bus 26	0.3793	0.7671	0.5769	0.7247	0.5525	0.6573	0.3553	0.2737	0.5449
Bus 27	0.3901	0.7334	0.5179	0.6658	0.4936	0.5983	0.3963	0.3713	0.5405
Bus 28	0.5605	0.9483	0.7581	0.9059	0.7337	0.8384	0.5365	0.1557	0.7261
Bus 29	0.5702	0.9580	0.7678	0.9156	0.7434	0.8482	0.5462	0.0828	0.7359
Bus 39	0.5220	0.8264	0.8426	0.9905	0.8182	0.9230	0.6309	0.8187	0.0000

From Table 1, we build the order of load shedding for each of the generator outage following in Table 2.

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Table.2: Proposed load shedding strategy

Order \ Bus	Bus 30	Bus 32	Bus 33	Bus 34	Bus 35	Bus 36	Bus 37	Bus 38	Bus 39
1	Load 25	Load 4	Load 20	Load 20	Load 23	Load 23	Load 25	Load 29	Load 39
2	Load 3	Load 7	Load 16	Load 16	Load 21	Load 21	Load 26	Load 28	Load 8
3	Load 18	Load 8	Load 24	Load 24	Load 16	Load 24	Load 3	Load 26	Load 3
4	Load 26	Load 15	Load 15	Load 15	Load 24	Load 16	Load 27	Load 27	Load 7
5	Load 27	Load 3	Load 21	Load 21	Load 15	Load 15	Load 18	Load 25	Load 4
6	Load 4	Load 12	Load 18	Load 18	Load 18	Load 18	Load 16	Load 18	Load 25
7	Load 16	Load 16	Load 23	Load 23	Load 3	Load 3	Load 4	Load 3	Load 18
8	Load 15	Load 18	Load 3	Load 3	Load 27	Load 27	Load 15	Load 16	Load 16
9	Load 24	Load 24	Load 27	Load 27	Load 4	Load 4	Load 24	Load 24	Load 27
10	Load 21	Load 27	Load 4	Load 4	Load 26	Load 26	Load 28	Load 15	Load 15
11	Load 39	Load 25	Load 26	Load 26	Load 25	Load 25	Load 29	Load 4	Load 26
12	Load 8	Load 21	Load 25	Load 25	Load 20	Load 20	Load 21	Load 21	Load 24
13	Load 7	Load 26	Load 8	Load 8	Load 8	Load 8	Load 8	Load 23	Load 21
14	Load 28	Load 23	Load 7	Load 7	Load 7	Load 7	Load 39	Load 8	Load 23
15	Load 29	Load 39	Load 28	Load 28	Load 28	Load 28	Load 7	Load 7	Load 28
16	Load 23	Load 28	Load 29	Load 29	Load 29	Load 29	Load 23	Load 39	Load 29
17	Load 20	Load 20	Load 39	Load 39	Load 39	Load 39	Load 20	Load 20	Load 12
18	Load 12	Load 29	Load 12	Load 12	Load 12	Load 12	Load 12	Load 12	Load 20

Explanation: According to the suggested strategy table above, if there is a fault at generator 30, the load shedding order will be Load 25 → Load 3 → Load 18 → ... until the system is stabilized again. Similarly, for the remaining generators.

4.4. Build a learning sample set, identify the input variable, output variable

The number of sample data received via off-line simulation

total plus 189 samples (including 21 load from 80% to 100%, per each level have 9 case with 9 generators outage).

Building a learning template is a file under [samples x variables]. The samples are rows, and variables are columns.

Samples data in the learning template under the vector include the variables to the ΔP_G (10), Δf_{bus} (39), ΔV_{bus} (39), ΔP_{load} (19) và ΔP_{branch} (46).

Total the input variables are 153 = (10 + 39 +39 + 19 + 46)

$$x = [\Delta P_G \; \Delta f_{bus} \; \Delta V_{bus} \; \Delta P_{load} \; \Delta P_{branch}]$$

The output variables y is assigned as following: y = [y1 STR1 STR2 STR3 STR4… STRn] = 13

where: y1 is the name of generator outage, STRn is strategic load shedding

Total results of the strategic load shedding on the Table 3

Table.3: Load shedding strategy for each generator fault

Strategic load shedding	Load to be shed
Strategic 1 (STR1)	L25
Strategic 2 (STR2)	L25, L3
Strategic 3 (STR3)	L4, L7
Strategic 4 (STR4)	L4, L7, L8
Strategic 5 (STR5)	L20
Strategic 6 (STR6)	L20, L16
Strategic 7 (STR7)	L23, L21, L16
Strategic 8 (STR8)	L23, L21, L24
Strategic 9 (STR9)	L25, L26, L3
Strategic 10 (STR10)	L25, L26, L3, L27
Strategic 11 (STR11)	L29, L28, L26, L27
Strategic 12 (STR12)	L39

Data consists of 189 samples and split into two subsets: training data and test data. Training data covers all generator faults at various load levels as well as covers all strategies load shedding when the generator faults.

Training data is 85% of the samples (162 samples), test data is 15% of the samples (27 samples).

4.5. Neural network training

The training of the neural network using the Back Propagation Neural Network (BPNN) with the Scaled Conjugate Gradient training algorithm was developed by Moller [10]. It was designed to reduce computational time at each step of the search, so the training time is faster and more optimal. It only needs 4 hidden layers neural and much less than the Levenberg-Marquardt algorithm. Meanwhile, the accuracy and error of the network is equivalent to the training method by Levenberg-

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Marquardt algorithm. The structure of the neuron network is shown in Fig. 9.

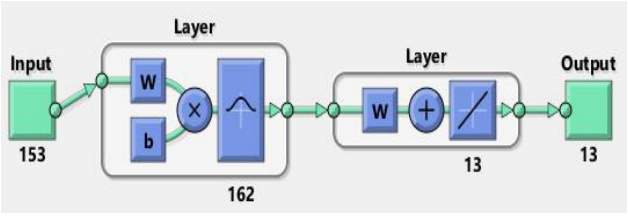

Fig. 9: Neural network training structure

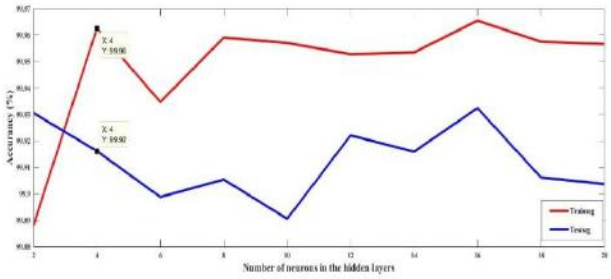

Fig. 10: The relationship between the number of neurons in the hidden layers and the accuracy

4.6. Test load shedding on the IEEE 39 bus New England by Powerwold.

Process simulation sampling with the IEEE 10 generators 39 bus are made as follows:

Assuming the generator outage is 34, at load level 100%, the frequency and deviation of the rotor angle become unstable.

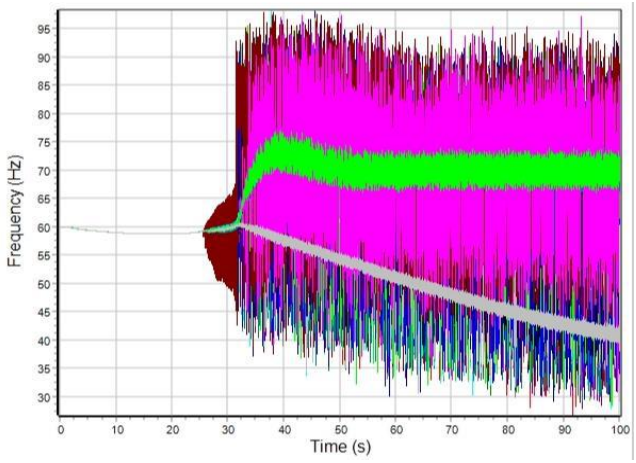

Fig. 11: Diagram of frequency of system at fault generator 34 load level 100%

When implementing the proposed method, just load shedding the load on bus 20, the frequency has stabilized.

V. COMPARISON OF METHODLOGY SUGGESTED WITH OTHER METHODS.

5.1. Load shedding based on under frequency load shedding relays [11].

Load shedding based on under frequency load shedding relays is the most commonly used method, which is still being used in many parts of the world, including Vietnam. When the grid frequency falls below the permitted threshold, the relay will be load shedding, prevents the system frequency declines. Without this load shedding control, the greatest possible consequence is the blackout and the widespread outage.

For example, the FRCC load shedding program, has a load shedding plan under frequency load shedding shown in Table 4.

Table.4: The FRCC load shedding program

UFLS Steps	Frequency (Hz)	Time delay (s)	Amount of load (% of member system)	Cumulative amount of load (%)
A	59.7	0.28	9	9
B	59.4	0.28	7	16
C	59.1	0.28	7	23
D	58.8	0.28	6	29
E	58.5	0.28	5	34
F	58.2	0.28	7	41
L	59.4	10	5	46

In case of fault at generator 34 the load is 100%, when the system frequency drops to 59.7Hz, it was load shedding 9% of total load. System frequency continues to fall, and when dropped to 59.4Hz, load shedding 7% of total load. The system frequency started to stabilize, the total load shedding was 16% (9% + 7%).

5.2. Load shedding based on the AHP algorithm (Analytic Hierarchy Process) [12]

AHP is the approach to making decisions. This method presents balanced assessment options and criteria, and integrates them into a final decision. AHP is particularly suitable for cases involving analysis and quantification, make decisions when there are multiple options depending on the criteria with multiple interactions.

Strategic load shedding according to the AHP algorithm is shown in Table 5.

Table.5: The order of load shedding according to the AHP algorithm

Order	Load
1	L31
2	L12
3	L18
4	L26
5	L23
6	L25
7	L21
8	L28
9	L24
10	L3
11	L16
12	L15
13	L29
14	L27

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15	L7
16	L20
17	L8
18	L4
19	L39

In the case of generator 34 outage, the load is 100%, load shedding according to AHP algorithm will be shed 31-12-18-26-23-25, the system is stability.

5.3. Simulation and results

Comparative results of the methods are presented in Table 6.

Table.6: Comparative results of the methods

Method	**Amount of load shedding (MW)**	**Frequency recovery time (s)**	**Frequency stability (Hz)**
UFLS relay	975,52	65	60,75
AHP	785,2	47	60,157
Proposed	628	35	60,030

In the case of generators 34 outage with a load level of 100%, the proposed method has many advantages over the AHP method and the low frequency method, as follows:

The proposed load shedding method reduced the amount of load by 347.52 MW (55.3%) compared to the traditional load shedding method and 157.2 MW (25%) compared to the load shedding method based on the AHP algorithm.

The proposed load shedding method had a frequency recovery time of 30 seconds (85.7%) compared to traditional load shedding and 12 seconds faster (34.3%) than load shedding based on the AHP algorithm. The simulation result is shown in Fig. 12.

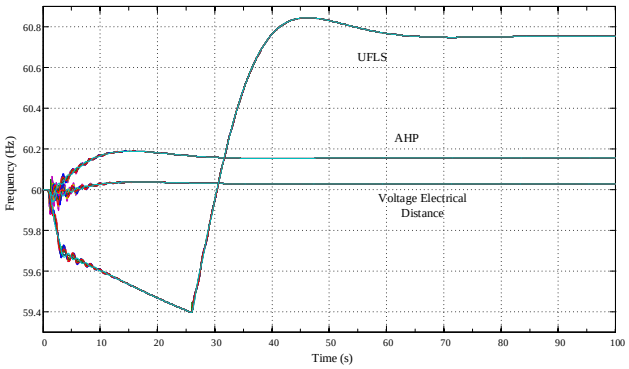

Fig. 12: Diagram of system frequency after generator 34 outage of all three methods of load shedding

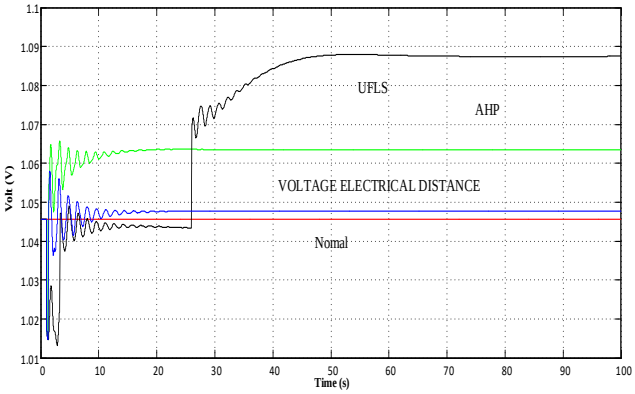

Fig. 13: Diagram of voltage after generator 34 outage of all three methods of load shedding

Table.7: Comparison of recovery voltages at 19 bus loads when 34 generators were lost for all three methods

		ULFC			**AHP**			**Proposed**		
Bus	Normal voltage (pu)	Recovery voltage (pu)	The change in voltage variation (%)	Recovery time (s)	Recovery voltage (pu)	The change in voltage variation (%)	Recovery time (s)	Recovery voltage (pu)	The change in voltage variation (%)	Recovery time (s)
Bus 3	1.054	1.094	3.74%	66	1.075	2.02%	52	1.056	0.14%	33
Bus 4	1.055	1.107	4.92%	85	1.082	2.58%	56	1.057	0.17%	33
Bus 7	1.056	1.109	5.07%	71	1.083	2.58%	54	1.057	0.15%	41
Bus 8	1.053	1.106	4.99%	71	1.079	2.49%	56	1.055	0.14%	47
Bus 12	1.045	1.105	5.71%	83	1.098	5.11%	53	1.047	0.19%	24
Bus 15	1.038	1.082	4.33%	72	1.059	2.05%	55	1.039	0.18%	29
Bus 16	1.046	1.084	3.68%	64	1.063	1.70%	38	1.048	0.18%	26
Bus 18	1.050	1.090	3.81%	85	1.074	2.27%	53	1.052	0.16%	34
Bus 20	0.993	0.990	0.27%	66	0.967	2.68%	27	0.998	0.47%	27
Bus 21	1.041	1.080	3.76%	67	1.059	1.73%	36	1.043	0.17%	32
Bus 23	1.049	1.090	3.93%	85	1.076	2.62%	34	1.051	0.20%	26
Bus 24	1.050	1.088	3.67%	69	1.068	1.76%	36	1.052	0.19%	34
Bus 25	1.065	1.098	3.16%	67	1.096	2.91%	43	1.066	0.12%	37
Bus 26	1.064	1.102	3.51%	67	1.091	2.48%	36	1.066	0.14%	27
Bus 27	1.052	1.092	3.76%	67	1.076	2.26%	31	1.054	0.15%	29
Bus 28	1.060	1.096	3.35%	70	1.081	1.97%	41	1.062	0.12%	26
Bus 29	1.058	1.092	3.18%	67	1.077	1.80%	35	1.059	0.12%	27
Bus 31	0.982	1.020	3.88%	70	1.002	2.00%	40	0.983	0.13%	29
Bus 39	1.030	1.038	0.73%	70	1.032	0.19%	44	1.030	0.02%	27
Average	**1.04**	**1.08**	**3.65%**	**71.68**	**1.07**	**2.27%**	**43.16**	**1.05**	**0.17%**	**30.95**

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In the case of generators 34 outage with a load level of 100%, the proposed method has many advantages over the AHP method and the low frequency method, as follows:

The proposed load shedding method has a voltage recovery time of 131.6% compared to conventional method and 39.5% compared to the AHP algorithm.

The proposed load shedding method has better recovering voltage values than traditional methods and AHP algorithm methods as follows: the change in voltage variation compared to the voltage before the fault of proposed load shedding method is 0.17%, the traditional method is 3.65% and the AHP algorithm method is 2.27%.

VI. CONCLUSION

The paper proposed a load shedding scheme with priority based on the voltage electrical distance between the generator outage and the load nodes to ensure system stability in the event of a severe load imbalance in the event loss a generator occurring in the electric system. The effectiveness of the proposed load shedding program has been demonstrated by analyzing the simulation results of the IEEE 39 system, 10 generators. The results show that: the method of load shedding proposed to reduce the amount of load shedding, frequency recovery time, faster voltage, and better recovery voltage values than traditional methods and algorithm AHP.

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Students' Level of Satisfaction on the Program and Services Offered by the NEUST, San Isidro Campus

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***Abstract*—** *This study described the level of satisfaction of 612 students on the different programs and services offered by the Nueva Ecija University of Science and Technology (NEUST), San Isidro Campus. The study found out that in general the students are very satisfied in the services offered by the campus particularly in their Guidance and Counselling, Career and Placement, Student Activities, Student Publication and Student Development, Scholarship and Financial Assistance, Sports Development, Culture, and the Arts, and Food Service. The finding indicates that the campus was able to comply with the enhanced guidelines and policies set by the Commission on Higher Education.*

***Keywords*— Evaluation, guidance and counselling, level of satisfaction, programs, services.**

I. INTRODUCTION

Education is said to be prestigious and perceived to be a fruitful investment that is rewarded in numerous ways [1]. It is normally presumed that formal schooling is an important contributor to the skills of an individual and to human capital (www.unesco.org).In today's competitive academic environment where parents and students have many options made available to them, factors that enable educational institutions to attract and retain students are being prioritized [2]. It has been mentioned by authors in [3] that competitive advantage in educational institutions can only be achieved by addressing the delivery of services to its customers, including the students as their main clientele.

The educational institutions are now battled with the purpose of providing quality services as this can be the primary reason for them to achieve sustainability. In the context of multicultural academic diversity that is now stimulated by globalization, it is necessary for all aspects of university life that includes student services, to meet these new challenges in today's era. Many aspects of student's life including academic, social or cultural level become more challenging to understand and manage with a population that finds itself in a state of continual growth and diversification [4]. The researchers in [5] emphasized that in order for the institution to become progressive of students' expectations, academic preferences and delivery perception about the educational environment should be kept by the higher authorities particularly the students who are at a higher academic level.

It is therefore important for universities to understand what the students valued most in their university experience [6], including their assessment towards the delivery of programs and services offered by their universities. This paper investigates the assessment of students on the delivery of the programs and services in Nueva Ecija University of Science and Technology (NEUST), San Isidro Campus: A basis for an assessment tool for student's programs and services in the Campus in particular and the NEUST in general. Nowadays, Higher Education Institutions are increasingly placing greater emphasis on meeting student's expectations and needs which makes this study well–timed. The significant findings of this study provided valuable information for administrators and curriculum planners to enhance policies [7] relating to services offered to college students of the said locale.

II. OBJECTIVES OF THE STUDY

This study determined the students' assessment on the delivery of programs and services in NEUST–San Isidro Campus. Specifically, it is based on the following objectives:

1. To determine the total number of students of NEUST San Isidro Campus categorized based on their college or department;
2. To describe the student's assessment on the delivery of programs and services in terms of:
   2.1 Student Welfare Services;

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2.1.1 Guidance and Counselling Services; and,
2.1.2 Career and Placement Services.
2.2 Student Development; and,
2.2.1 Student Activities; and,
2.2.2 Student Publication.
2.3 Institutional Development Programs
2.3.1 Scholarship and Financial Assistance;
2.3.2 Admission Services/Registrar's Services;
2.3.3 Student Development Programs and Services;
2.3.4 Sports Development Services;
2.3.5 Culture and the Arts Services; and,
2.3.6 Food Services.

3. To design a tool in assessing students' services and programs on the campus.

III. METHODOLOGY

This study utilized evaluation research which focuses on assessing the satisfaction of the students in the delivery of services and programs of NEUST, San Isidro Campus. According to [8], "evaluation research should enhance knowledge and decision making and lead to practical applications" [9].

The researcher targeted 612 student–respondents who were randomly selected from the enrollees of NEUST San Isidro Campus during the first semester of the A.Y. 2018–2019. The survey was conducted from August to November of 2018. It was designed to assess the 10 student's programs and services mandated by the Commission on Higher Education based on CMO No. 9, Series of 2013 [10]. Furthermore, in this study, the stratified sampling method was used to determine the number of participants in the study and the survey questionnaire was developed based on the mandates of CHED on the policies and guidelines on student affairs and services.

Scoring: Each response to every item was evaluated based on the following scale and verbal interpretations:

Response

Scale of Values	Scale of Range	Verbal Description	Interpretation
5.00	4.21 – 5.00	Strongly Agree	The student is very satisfied with the delivery of services and programs
4.00	3.41 – 4.20	Agree	The student is satisfied with the delivery of services and programs
3.00	2.61 – 3.40	Moderately Agree	The student is moderately satisfied with the delivery of services and programs
2.00	1.81 – 2.60	Slightly Agree	The student is slightly dissatisfied on the delivery of services and programs
1.00	1.00 – 1.80	Disagree	The student is dissatisfied on the delivery of services and programs

Statistical tools utilized in this study were frequency, percentage and weighted mean.

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IV. RESULTS AND DISCUSSION

1.The total number of students of NEUST San Isidro Campus based on their department.

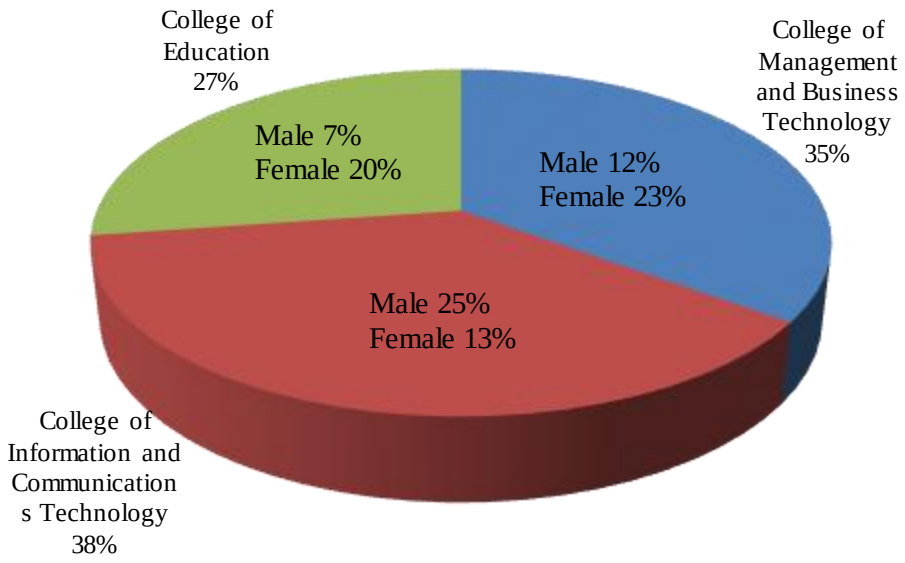

Fig.1: Distribution of Respondents per Department

The 612 student–respondents were randomly selected from the enrollees of the NEUST–San Isidro Campus during the first semester of the A.Y. 2018–2019. It has been noted from the data above that among the three departments, the College of Information and Communications Technology have the most number of enrollees. It also shows that the majority of the students in the CICT are male. Indeed, the computer industry has been traditionally viewed as a male–dominated profession [11]. Many students were interested in taking the said course because information technology is incredibly diverse which is not just confined in work related to fixing computers or laptops. This course allows an individual to have a career opportunity in a number of different directions which vary from a technical writing, web developing, information technology directorship, chief technology connected works and others[12].

2.Assessment of the Respondents on Guidance and Counselling Services

Table.1: Assessment of Guidance and Counselling Services

Considerations	Weighted Mean	Verbal Description
1. There is a Campus Guidance Office beside the Office of the Student Affairs headed by a competent Guidance Coordinator.	4.63	Strongly Agree
2. Guidance and counseling services are made available in the Campus where one can immediately go to.	4.48	Strongly Agree
3. There is a counseling room provided to ensure privacy and confidentially of counseling sessions.	4.42	Strongly Agree
4. The guidance coordinator observes confidentiality of problems.	4.43	Strongly Agree
5. The guidance office serves as the liaison I intervening problems among and between students, faculty–students and other concerned academic concerns.	4.37	Strongly Agree
Average Weighted Mean	**4.47**	**Strongly Agree**

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According to [13], guidance is an imperative part of every child's development and education. Guidance and Counselling services are an integral part of every academic institution; it is part of the student services provided to assistthem in resolving and coping with conflicts arising from a changing society[14]. It is observed from the data above that the students are very satisfied with the delivery of services of the said office. This only implies that the campus is compliant with the guidelines and policies set by the Commission on Higher Education linked with the Guidance services as stipulated above.

3.Assessment of the Respondents on Career and Placement Services

Table.2: Assessment of Career and Placement Services

Considerations	Weighted Mean	Verbal Description
1. There is an Alumni office in the Campus that keeps records of graduates for future references.	4.51.	Strongly Agree
2. The Alumni office has a file of Tracer study on the whereabouts of the graduates and is being monitored.	4.33	Strongly Agree
3. Informative materials are made available and are posted on bulletin boards on job opportunities in skill development programs.	4.32	Strongly Agree
4. Regular career and job placement services are available for the students most especially for graduating students.	4.32	Strongly Agree
5. The Alumni office coordinates with the community, public and private agencies, Alumni, for possible placements for students.	4.29	Strongly Agree
Average Weighted Mean	**4.35**	**Strongly Agree**

The college career and placement services department is like a travel agency in this analogy and offers a variety of services to the student travellers [15]. The student–respondents were very satisfied with the services of this office which means that graduates are given better opportunities after graduation due to the compliance of the university when it comes to their placement. It has been stated by [16] that upon the completion of the student's degree, if the students would not attain a higher level of education like Master's degree, they would rather pursue careers and that makes the services of this office essential.

4.Assessment of the Respondents on Student Activities

Table.3: Assessment of Student Activities

Considerations	Weighted Mean	Verbal Description
1. There is an office for students development programs and services known as the OSOAD (office for student organization activities and development) manned by a competent and committed head and adviser	4.44	Strongly Agree
2. The OSOAD helps and assists the student–officer in the planning and conduct of co–curricular activities.	4.44	Strongly Agree
3. There are guidelines being followed in choosing officers for political student organizations as University Students Government– USG and the different Campuses/Colleges' student council officers.	4.33	Strongly Agree
4. Applications forms for recognition and renewal of recognition for non–political student organizations are readily available and accessible at the OSOAD and CSC office.	4.33	Strongly Agree
5. Every student's organization are guided by qualified and competent faculty–advisers who served as their fathers/mothers during the conduct of the plan activities such as leadership programs and other related student activities.	5.00	Strongly Agree
Average Weighted Mean	**4.51**	**Strongly Agree**

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Student's activities under student development programs and services delivered their services to the students in a very satisfactory level with a 4.51 average weighted mean. According to authors in [1], the satisfaction of the students on the services they received from the university which includes the office that caters students' activities plays a major role in determining the delivery of services of an educational system; they also revealed that the higher the level of satisfaction of the student–clienteles, the higher will be the level of students' grooming their skill development, course knowledge and mentality.

5.Assessment of the Respondents on Student Publication

Table.4: Assessment on Student Publication

Considerations	Weighted Mean	Verbal Description
1. There is an office for Campus paper publication known as "The Anihan manned by a competent and knowledgeable head and adviser"	4.42	Strongly Agree
2. The school publication place a liaison between the students and the administration on issues relative to education and related concerns.	4.27	Strongly Agree
3. The publication issues The Anihan magazine's ones every semester.	4.13	Agree
4. The contents of publishing issues are relevant to the students–subscribers.	4.23	Strongly Agree
5. The publication solicits articles from the students and considers suggestion and comments of students for publication.	4.21	Strongly Agree
Average Weighted Mean	**4.25**	**Strongly Agree**

It is observed from the data above that the campus managed to deliver the services concerning the student's publication very satisfactory with an average weighted mean of 4.25. The idea of establishing a student publication which can be in the form of print and non–print media of the university is supported by the Commission on Higher Education as provided by R.A. No. 7079 otherwise known as, "Campus Journalism Act of 1991" [10]. The school publication is a significant avenue that is an outlet which intensively covers things that matter to both the student–journalists and the stakeholders they cover [17].

6.Assessment of the Respondents on Scholarship and Financial Assistance

Table.5: Assessment of Scholarship and Financial Assistance

Considerations	Weighted Mean	Verbal Description
1. There is an office for a scholarship under the office of the student affairs that caters the scholarship program of the Campus.	4.57	Strongly Agree
2. Scholarship brochures are made available at the center why the dissemination of information and easy access on scholarship programs' concerns, requirements, guidelines and the like.	4.35	Strongly Agree
3. Departments of Campus provided with clear application procedures in the application of different scholarships and/or financial grants–in–aid programs.	4.27	Strongly Agree
4. The scholarship center and gives prompt service to the applicants in processing their papers.	4.41	Strongly Agree
5. The applicants undergo screening and are given enough time to process their application.	4.28	Strongly Agree
Average Weighted Mean	**4.38**	**Strongly Agree**

The data above revealed that the student–respondents were satisfied with the delivery of services related to scholarship and financial assistance of the campus with an average weighted mean of 4.38. In the Philippines, which is a developing country, there are many high school graduates who cannot be sent by their parents to school due to poverty.

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In this case, scholarships play an important role in making college for student–scholars more accessible and affordable, and paving the way for students to be successful in both their pursuit and completion of their degree[18]. Thus, the availability of scholarships and the services this office provides creates a strong foundation for supporting students in their schooling. Actually, in the study previously conducted by the researchers in [19], one of the factors being considered by the students in choosing their college is the scholarships and grants offered by the institution.

7.Assessment of the Respondents on Admission Services/Registrar's Services

Table.6: Assessment on Admission Services/Registrar's Services

Considerations	Weighted Mean	Verbal Description
1. There is a registrar's office located at the Campus where the enrolment procedure is carried out.	4.33	Strongly Agree
2. Student's grades are released on time.	4.10	Agree
3. There is a clear procedure on completion of grades.	4.23	Strongly Agree
4. Request for certification is acted upon promptly.	4.15	Agree
5. Credential evaluation is carried out promptly.	4.17	Agree
Average Weighted Mean	**4.20**	**Agree**

The data above disclosed that the admission and registrar services in the campus are perceived to be satisfactory by the students in terms of their services delivery with an average weighted mean of 4.20. This result only shows that said office fully delivers the quality services demanded by the student–respondents which are linked with the accuracy and timeliness in the release of information and records from the Registrar's Office. According to [20], the role of the registrar in a school is no longer confined in mere record keeping. He emphasized that it has already evolved from keeping and safeguarding student records to data analysis and management relevant to school planning and decision–making. He also added other functions that range from troubleshooting to marketing of the school.

8.Assessment of the Respondents on Student Development Programs and Services

Table.7: Assessment of Student Development Programs and Services

Considerations	Weighted Mean	Verbal Description
1. There is an office for students development programs and services known as the OSOAD (office for student organization activities and development) manned by a competent and committed head and adviser	4.44	Strongly Agree
2. The OSOAD helps and assists the student–officer in the planning and conduct of co–curricular activities.	4.44	Strongly Agree
3. There are guidelines being followed in choosing officers for political student organizations as University Students Government– USG and the different Campuses/Colleges' student council officers.	4.33	Strongly Agree
4. Applications forms for recognition and renewal of recognition for non–political student organizations are readily available and accessible at the OSOAD and CSC office.	4.33	Strongly Agree
5. Every student's organization are guided by qualified and competent faculty–advisers who served as their fathers/mothers during the conduct of the plan activities such as leadership programs and other related student activities.	5.00	Strongly Agree
Average Weighted Mean	**4.51**	**Strongly Agree**

When it comes to student development programs and services, the student–respondents divulged that they were very satisfied with the delivery of such services with an average weighted mean of 4.51. This assessment only implies that the students are equipped with activities that meet their envisioned learning outcomes. Students perceived that the development programs of the campus are significant in their development and growth as an individual

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and as future professionals. They appreciated the accessibility and the guidance of the office to their different planned pieces of training and activities such as leadership pieces of training, team building, seminars, workshops, exhibits, quiz bees, paper presentations and many other extracurricular activities that are separated from their academic endeavors.

9.Assessment of the Respondents on Sports Development Services

Table.8: Assessment of Sports Development Services

Considerations	Weighted Mean	Verbal Description
1. There is a school canteen located at the Campus.	4.32	Strongly Agree
2. There is a certificate to operate/sanitary permit posted/displayed in a prominent area of the food outlet.	4.36	Strongly Agree
3. There are enough food kiosks available which cater clean and nutritious food within the Campus.	4.36	Strongly Agree
4. Foods are properly leveled as to its name and price.	4.36	Strongly Agree
5. Canteen personnel and helpers observe proper grooming.	4.40	Strongly Agree
Average Weighted Mean	**4.36**	**Strongly Agree**

The data above shows the assessment of the students on the sports development services of the campus with an average weighted mean of 4.36. The results have presented that the student–athletes were very satisfied with the services of such an office. As stated in[21], in the eyes of many students; sport, physical activity, and wellbeing plays an important part in university life. In fact, [22] cited that sports help an individual much more than in the physical aspects alone. He stressed out that it also builds our students' character, teaches and develops their strategic thinking, analytical thinking, leadership skills, goal setting, and risk–taking, just to name a few welfares.In the study conducted by the researchers in [23], it was found out that the participation of the students in school athletics has a positive significant relationship in their academic performance which only implies that sports development programs supporting school athletes must be given full attention to enhancing the wellness of the students.

10.Assessment of the Respondents on Culture and the Arts Services

Table.9: Assessment of Culture and the Arts Services

Considerations	Weighted Mean	Verbal Description
1. There is an Office that manned and guide the Culture & the Arts Services known as the LCDC (Literary–Cultural Development Center)	4.39	Strongly Agree
2. The students are properly screened as to their grades & talents before they can join the LCDC and are given the chance to avail institutional scholarship.	5.00	Strongly Agree
3. The LCDC is developing students to become highly competitive in any arts & culture competition.	4.31	Strongly Agree
4. The LCDC is fully supported by the University in promoting culture and arts activities.	4.28	Strongly Agree
5. Coaches and trainers are highly competent and qualified.	4.37	Strongly Agree
Average Weighted Mean	**4.36**	**Strongly Agree**

The data above indicates that the student–respondents of NEUST San Isidro Campus were very satisfied with the culture and arts services of the campus and it has an average weighted mean of 4.36. Based on the CHED Memorandum Order No. 09, Series of 2013, the university must provide opportunities for the students to realize the importance of the culture and the arts. This is the door to promote the culture of the Philippines and make the students appreciate the value of preserving our culture [10]. The presence of the office is an important part of cultural education, which

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pushes the students to make a reflection in the culture of this country and builds respects on other countries' culture as well.

11.Assessment of the Respondents onFood Services

Table.10: Assessment of Food Services

Considerations	Weighted Mean	Verbal Description
1. There is a School Canteen located at the Campus.	4.32	Strongly Agree
2. There is a Certificate to Operate/ sanitary permit posted/displayed in a prominent area of the food outlet.	4.36	Strongly Agree
3. There are enough food kiosks available which cater clean & nutritious food within the Campus.	4.36	Strongly Agree
4. Foods are properly labeled as to its name and price.	4.36	Strongly Agree
5. Canteen personnel and helpers observed proper grooming.	4.40	Strongly Agree
6. There is a School Canteen located at the Campus.	4.32	Strongly Agree
Average Weighted Mean	**4.36**	**Strongly Agree**

In the data above, it has been revealed that the students were very satisfied with the food services of the campus with an average weighted mean of 4.36. This only denotes that there is an available, adequate, safe and healthy food within the school premises or even to immediate vicinity around the campus. Their compliance is in accordance with the sanitation guidelines of the Department of Health with regards to food establishments [24].

V. CONCLUSIONS AND RECOMMENDATIONS

Majority of the enrollees in the campus took the courses being offered from the College of Information and Communications Technology and this department is a male–dominated department. From the results, Guidance and Counselling, Career and Placement, Student Activities, Student Publication and Student Development, Scholarship and Financial Assistance,Sports Development, Culture and the Arts, and Food Servicedelivered their programs and services very satisfactory which shows that they were able to comply with the enhanced guidelines and policies set by the Commission on Higher Education.

On the other hand, the Admission Services/Registrar's Services was rated satisfactory in the delivery of their servicesto the students which is an indicator that this area must be further improved.

Based on the findings, the following recommendations were formulated: The NEUST, San Isidro Campus should check the area that is not rated very satisfactory by the students to have a clearer picture of the lack of excellence in the delivery of the service. Furthermore, the NEUST as an institution which aim is to deliver excellent service must continue to evaluate their programs and services in all its existing colleges and campuses to assure that they are providing quality assistance to their clienteles.

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The Leadership Style of Headmaster in Guiding the Character of Teachers in the Public Senior High School 2 Limboto

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Abstract**—** *This research aims to (1) discover the democratic leadership style in guiding the characters of teachers at Public Senior High School 2 Limboto, (2) to know the autocratic leadership style in guiding the characters of teachers at Public Senior High School 2 Limboto, (3) to know the paternalistic leadership style in guiding the characters of teachers at Public Senior High School 2 Limboto, (4) to know the laissez-faire leadership style in guiding the characters of teachers at Public Senior High School 2 Limboto. This research was an explanatory research and the method used was survey method, whereas the number of population and the sample was 34 people. Then, from the research was obtained some results, they were: (1) the implementation of democratic leadership style in guiding the characters of teacher, it was obtained the very high category that was the average score 3,29, (2) the implementation of autocratic leadership style in guiding the characters of teacher and obtained the average score 3.00 with high category, (3) the implementation of paternalistic leadership style in guiding the characters of teacher, it was obtained the average score 3,23 included the very high category, and (4) the implementation of laissez-faire leadership style in guiding the characters of teacher, it was obtained the average score 1,32 and belonged to low category.*

Keywords**— Leadership Style, Guidance, Character of teachers.**

I. INTRODUCTION

One of the problems being faced by our nation is about character. One alternative offered to solve the character problem is by conducting a good education. Education is considered as an alternative which has preventive characteristic because education establish the better new generation of nation. As an alternative which has preventive characteristic, education is expected to develop and minimize the cause of various problems of culture and nation's character. It should be admitted that the result of education can't be instantly seen, but it has a strong resistance and effect among the societies.

Teacher is an education doer who has strategic position to realize the purposes of character building as mandated by Pancasila and also in the *preambule* (opening) of Indonesia's basic constitution 1945 and it is more emphasized with the constitution number 20 Year 2003 about the National Education System where the function and the purpose of national education are " the national education has the function to develop and form the character and the good civilization of the nation, which has purpose to develop the students' potency so they can become faithful human and obey the God, having the good characters, healthy, having knowledge, capable, creative, independent, and becoming democratic and responsible citizens".

Teacher is the first people in the practice of education who should become the pattern for his students. Teaching, educating, and training are the main duty of teacher and becoming a strategic position in educating characterized students. As mentioned in the Regulation of Ministry of the Utilizing of Civil Servants and Reformation Number 16 Year 2009 about the Teachers' Functional Position and Its Credit Number, it is explained that the primary duties of teachers are to educate, teach, guide, direct, train, assess, and evaluate the students in the early age education in some categories such as formal education, basic education, and middle age education and also the additional duty which is relevant with the function of school/*madrasah*.

Character according to Language Centre National Education Department is the heart, soul, personality, manner, behaviour, characteristic, temperament, and mind. Whereas, according to the Ministry of National Education (2010:3), character is a characteristic, behaviour, or someone's personality which is formed from the internalisation result of various virtues which are believed and were used as the background of the way to see, think, behave, and act.

The leadership of headmaster is the key to the success or failure of a school organization, therefore the leadership style used by the headmaster is one of the factors in creating a conducive school climate and also the good school performance. The school climate is closely related to the leadership style of the headmaster, because the headmaster is the highest policy maker in the school. The accuracy of the headmaster in choosing a leadership style will lead to the achievement of school goals. As Mulyasa (2012: 5) states that the success or failure of

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education and learning in school is strongly influenced by the ability of headmaster in managing each component of the school (who is behind the school).

Based on the results of observations and preliminary interviews with the headmaster, the author can conclude that the headmaster's leadership style in fostering teacher character uses 4 (four) leadership styles, they are: 1) democratic leadership style, 2) autocratic leadership style, 3) paternalistic leadership style and laissez faire leadership style. Of the four leadership styles, the author was interested in conducting research in order to study further by using questionnaires distributed to teachers and deepened through interviews with the school headmasters, vice headmaster, teachers and administration staffs. This thing was purposed in order to describe the leadership style of the headmaster in fostering the teacher's character which consisted of independent character, creative character, discipline character and hard work character. This thing is the background that cause the author is very interested in conducting research with the title "Principal Leadership Style in Fostering Teachers' Character in Public Senior High School 2 Limboto".

II. LITERATUR REVIEW

1. The Essence of Headmaster's Leadership Style

Leadership according to Thoha (2010: 9) means that: "Leadership is the ability to influence people to be directed towards the achieving of organization's goals". According to Wahyudi (2009: 120), it can be interpreted as: "A person's ability to move, direct, and influence the mindset and workings of each member, in order to be independent in working. While according to the National Education Department (1999) in Syafaruddin (2010: 88) states, "Leadership is the way or effort of the headmaster in influencing, encouraging, guiding, directing, and mobilizing teachers, staffs, students, parents, and other parties involved in working or participate in achieving the goals ".

The definition above is supported by the opinion of Soekarto Indrafachrudi in his book *Bagaimana memimpin Sekolah yang Efektif* (How to lead an Effective School) (2006: 3), giving the meaning of leadership as follows: "Leadership is an activity in guiding groups in such a way that the group's goals are achieved". Whereas according to Masaong (2011: 161) leadership functions as an action taken by the headmaster in an effort to mobilize teachers to do something to realize the formulated work program". This is reinforced by Husaini Usman (2009: 280), "Leadership is a deep relationship of a leader, to influence other people to establish a conscious cooperation in the relationship of the tasks that should be done".

The headmaster's leadership process is related to the leadership style which is used. From various headmaster's leadership styles, situational style tends to be more flexible in the school operational condition. The situational leadership style departs from the point that there is no best leadership style of the headmaster that can be used, but depends on the situation and condition of the school. These situations and conditions include the level of maturity of teachers and staffs, which can be seen from two dimensions: the dimension of ability (awareness and understanding) and the dimension of willingness (responsibility, care and commitment).

Furthermore, according to Sondang Siagian (2006: 74), "The leadership style applied by a leader is various". This is caused by differences in motivation that a leader has in conducting his duties. According to Sondang Siagian (2006: 254), the leadership style consists of: 1) Democratic leadership style, 2) Autocratic leadership style, 3) Paternalistic leadership style, and 4) Laissez-Faire leadership style.

2. The Character of Teachers

To know the meaning of character, it can be seen from two sides, those are from the linguistic side and the terminology side. According to language (etymologically) the term character originates from the Latin language *kharakter*, *kharassaein*, and *kharax*. In the Greek character, it is originated from the word *charassein*, which means to sharpen and to deepen. In English, it is called as character and in Indonesian are commonly known with the term *karakter* (Gunawan, 2012: 1). Meanwhile in the Indonesian Language Dictionary, the Ministry of National Education Language Center states that character means mental, moral or character traits that distinguish a person from others, or means innate, heart, soul, personality, character, behavior, personality, character, character, temperament, character. So the term character means having character, having personality, and behaving. Individuals who have good character to excel are someone who tries to do the best things to the God, himself, others, environment, nation, and country and the international world in general by optimizing his potential (knowledge) and accompanied by the awareness, emotion and his motivation (feeling).

According to the General Directory Ministry of National Education (2011: 8) Character is behavior based on values based on the religious norm, culture, law / constitution, custom, and aesthetic. The constitution Number 20 Year 2003 Article 3 of the National Education System, which states that national education functions to develop capabilities and form the national character and civilization to develop potential students to become human beings who are knowledgeable, capable, creative,

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independent and become citizens who are democratic and responsible.

According to the Constitution of Indonesia Number 14 Year 2005 about Teacher and Lecturer, in chapter 1 article 1 states that: "Teachers are professional educators with the main task to educate, teach, guide, direct, train, assess and evaluate students in early childhood education formal education, basic education, and secondary education. "

According to Koswara Deni and Halimah (2008: 29) "Teachers are all people who are responsible for the education of students, both individually and classically, both in school and outside school, who must master various competencies such as pedagogy, personality, social and profession".

Based on the description above, the teacher's character is the psychological, moral or ethical characteristics in conducting the task of educating, teaching, guiding, directing, training, assessing and evaluating students based on the values based on the religious norm, cultural, legal / constitutional, custom, and aesthetic.

III. RESEARCH METHOD

This research was conducted at the Public Senior High School 2 Limboto. The study was conducted for 3 (three) months, started from March to June 2016 which included observation, preparation, data collection through the analysis of document, observation, interview and questionnaire to the preparation of research reports. This research was explanatory research. The study used a descriptive design that aimed to describe the leadership style of the headmaster in fostering teachers' character in Public Senior High School 2 Limboto based on the characteristic of the studied object. The population in this study was the all characteristics, objects and other objects related to the leadership style of the headmaster in fostering the character of the teachers in Limboto 2 High School. The respondents used were 34 teachers (including vice headmaster, treasurer and administrative staff).

The data collection technique that will be used to support problem solving are, as follows: a) questionnaire, b) interview, c) documentation. The data obtained will be analyzed using descriptive statistical analysis then data that has been analyzed quantitatively are deepened or strengthened by the results of interviews.

IV. RESULTS

The results of the research on the democratic leadership style of the head of Public Senior High School 2 Limboto were measured by questionnaires and confirmed by the results of interviews showed that character building responsibility through delegation, from the tendency of respondents' answers, 17 respondents or 50.00% answered with category never. The creativity character fostering through providing support, from the tendency of respondents, 16 respondents or 47.06% answered with the category always. The development of character discipline through sanctions, from the tendency of respondents, 18 respondents or 52.9% answered with the category always. The hard work character fostering through the awarding, from the tendency of respondents, 11 respondents or 32.35% answered with the category ever.

The autocratic leadership style of the headmaster of Public Senior High School 2 Limboto was measured by using a questionnaire and confirmed by the results of interviews, showed that the guidance of the independence character through delegation, from the tendency of respondents' answers, 14 respondents or 41.18% answered with the category always. The creativity character fostering through the providing of support, from the tendency of respondents, 14 respondents or 41.18% to respond with category never. The development of character discipline through the sanction, from the tendency of respondents, 34 respondents or 100% to respond with category never. The hard work character fostering through the awarding, from the tendency of respondents, 29 respondents or 85.29% to respond with category never.

The paternalistic leadership style of headmaster of the Public Senior High School 2 Limboto which was measured by using questionnaires and confirmed by the results of interviews showed that the guidance of the independence character through delegation, from the tendency of respondents' answers, 12 respondents or 35.29% answered with the always category and 12 respondents or 35.29% answer with frequent categories. The creative character fostering through the providing of support, from the tendency of respondents, 16 respondents or 47.06% answered with the category always. The development of character discipline through the giving of sanction, from the tendency of respondents, 30 respondents or 88.24% to respond with category never. The hard-working character fostering through the awarding, from the tendency of respondents, 18 respondents or 52.94% answered with category never.

The laissez-faire leadership style of Public Senior High School 2 Limboto was measured by using a questionnaire and confirmed by the results of interviews, showed that the guidance of the character of the independence through delegation, from the tendency of the respondents' answers, 34 respondents or 100% answered with category never. The creative character fostering through the giving of support, from the tendency of respondents, 31 respondents or 91.18 % respond with

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category never. The development of character discipline through the giving of sanction, from the tendency of respondents, 24 respondents or 70.59% answered with category never. The hard work character fostering through the awarding, from the tendency of respondents, 30 respondents or 88.24% respond with category never.

V. DISCUSSION

For the data processing in the study used the Weighted Means Score (WMS) formula by calculating the frequency of respondents who chose the alternative answer, then multiplied by the weight of the alternative value itself. Followed by calculating the average value ($\bar{x}$) for each item statement in the questionnaire, using the Weighted Means Score (WMS) formula and matching the average with the frequency table calculated by WMS as contained in the previous chapter.

Then, it will be presented in the result of research data processing using the WMS calculation technique on the answers of 34 respondents to the statements contained in the questionnaire related to the headmaster's leadership style in fostering teachers' character in Public Senior High School 2 Limboto, Gorontalo.

1. Democratic Leadership Style

The highest average score in implementing a democratic style is the development of discipline character with a score of 3.29 compared to fostering creative character with a score of 3.24. It means that the democratic leadership style of the headmaster of Public High School 2 Limboto in fostering teacher character is focused on the character of discipline and then the creative character and subsequently the character of hard work and independence.

The results of the processing of the instruments were strengthened and deepened by some interviews conducted by the researcher with several informants, they were: the headmaster, the vice headmaster, teachers and administration staffs. From the results of interviews with one of the teachers, information was obtained that the headmaster was very focused on the discipline of the teacher, the headmaster was very unhappy if the lesson time took place there were classes that did not study while the teacher was only on the teacher board to complete other work. In line with one of the deputy principals, it was revealed that the principal often said whatever work was done if there were teaching hours so leave the job and go to class to fulfill the obligations as a teacher. The results of interviews with the headmaster of Public Senior High School 2 Limboto 2 justified the statement above because according to him that the root of all problems was the disciplinary problems such as the time discipline, work discipline, discipline in dress or discipline in obeying all rules and norms as a teacher.

The results of the interview above are reinforced by Siagian (in Sutrisno, 2009: 86), a good form of discipline will be reflected in the atmosphere in the school organization, they were: (1) the high teacher awareness towards achieving the school's vision and mission, (2) the high enthusiasm , work passion and initiative of the teachers in teaching, (3) the great sense of responsibility of the teacher to conduct the task as well as possible, (4) the development of a sense of belonging and a high sense of solidarity among teachers, and (5) increasing work efficiency and productivity . Furthermore, emphasized by Indrafachrudi (2006: 17) one of the characteristics of democratic style is the high discipline.

2. Autocratic Leadership Style

The highest average score in the application of autocratic leadership style is independent character guidance with a score of 3.00 compared to the guidance creative characters with a score of 2.06. It means that the autocratic leadership style of the headmaster of Public Senior High School 2 Limboto in fostering teachers' character is emphasized on the character of independence, creative character and furthermore the character of hard work and discipline.

The results of processing of the instruments were strengthened and deepened by the interviews conducted by the researcher with several informants, they were: the headmaster, the vice headmaster, teachers and administration staffs. From the results of interviews with a teacher, the information obtained that one form of strict supervision conducted by the headmaster was the presence of CCTV cameras throughout the classroom, which were monitored directly from the headmaster's room. Meanwhile, according to the vice headmaster, information was obtained that in Public Senior High School 2 Limboto, the teachers had been given facilities to support their respective duties and functions. Therefore the headmaster often reminds them not to interfere with each other's tasks, they should work according to their duties.

The description above is more emphasized by the headmaster from the interviews obtained information that the main purpose of CCTV camera installed in all classrooms is to monitor and supervise directly the independence of teachers in the learning process in the classroom.

Based on the description above, it can be concluded that the headmaster of Public Senior High School 2 Limboto in fostering the character of independence uses the autocratic leadership style by delegating responsibility with the close supervision. This is reinforced by the opinion of Siagian (in Hikmat, 2009: 254) one of the characteristics of the style of autocracy is

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Monitoring / supervision of the implementation of tasks by subordinates conducted strictly, so that tasks can be accomplished.

3. Paternalistic Leadership Style

The highest average score in implementing the externalistic style is the guidance of the creative character with a score of 3.23 compared to independent character guidance with a score of 2.91. It means that the paternalistic leadership style of headmaster of Public Senior High School 2 Limboto in fostering the teacher's character is focused on the creative character, independent character and subsequently the character of hard work and character of discipline.

The results of the processing of the instruments were strengthened and deepened by interviews between researcher and several informants, they were: the headmaster, the vice headmaster, teachers and administration staffs. From the results of interviews with a teacher, information was obtained that the principal always provided motivation to the teachers so that creativity in learning was developed. As a manifestation of the principal's support for teachers' creativity, all facilities or needs will be provided by the school as long as the budget is available for this purpose. This is similar to that expressed by the deputy headmaster of the public relations sector, stating that the principal has never obstructed the desire of teachers to be creative in learning even if possible, all of his needs will be met to realize his creativity.

This was emphasized more by the headmaster who stated that one of the conditions for achieving learning objectives if the teacher was able to choose and determine the right media which is suitable with the material, but often the media was not available or damaged. With that condition, of course teachers' creativity is expected, but how can the teacher be creative if the needs have to be provided by themselves, therefore the school strives to hold all the needs for the creation of teachers' creativity in the learning process

Based on the description above, it can be concluded that the headmaster of Public High School 2 Limboto in fostering the character of creativity uses a paternalistic leadership style by preparing everything needed to develop teachers' creativity. This is reinforced by Siagian's opinion (in Hikmat, 2009: 254) that paternalistic leadership style always considers subordinates as human beings who are not yet mature, or their own children who need to be developed, fulfill all their needs and protect his/her subordinates.

4. *Laissez-Faire* Leadership Style

The highest average score in the implementation of laissez-faire style is the development of disciplinary characters with a score of 1.32 compared to the guidance of hard working character with a score of 1.12. It means that the laissez-faire leadership style of headmaster of Public Senior High School in fostering teacher character is emphasized on the character of discipline, character of hard work and subsequently creative character and independent character.

The results of the processing of the instruments were strengthened and deepened by interviews conducted between researcher and several informants, the informants were the headmaster, the vice headmaster, teachers and administration staffs. From the results of interviews conducted with a teacher, information was obtained that the headmaster had never given sanctions when teachers broke the disciplinary rules. This was confirmed by the headmaster that as a human being who has a heart and feelings, of course it is hard to give sanctions to teachers who arrive late because of the accidental factors.

VI. CONCLUSION

Based on data analysis using the Weighted Means Score (WMS) technique about the headmaster's leadership style in fostering teachers' character in Public Senior High School 2 Limboto. Then, it can be concluded that the implementation of democratic leadership styles in fostering teachers' character, the highest average score was obtained by disciplinary character development with a score of 3.29 including the category always. The implementation of the autocratic leadership style in fostering the character of the teacher, the highest average score was obtained by fostering independent characters with a score of 3.00 including the category often. The implementation of the paternalistic leadership style in fostering the character of the teacher, obtained the highest average score was the guidance of creative characters with a score of 3.23 including the category always. The implementation of laissez-faire leadership style in fostering the character of the teacher, obtained the highest average score was disciplinary character development with a score of 1.32 including the category ever.

Based on the conclusion above, the following research implications are stated: 1) democratic style, autocratic style, paternalistic style, and laissez-faire style in Public Senior High School 2 Limboto in fostering teachers' character have implications for improving the character of discipline, independent character, creative character and hard work character, 2) the implementation of the appropriate leadership style will have implications for the work climate, work culture and high work motivation, and 3) the implementation of good teacher

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character will have implications for the character of students who were also good.

Based on the conclusions, it is suggested following suggestions: 1) the headmaster should apply the right leadership style for the development of a characterized teacher, 2) As a characterized teacher should conduct all of his duties and responsibilities as a teacher and educator and obey all rules and norms, especially in the institution she/he serves, and 3) the government in this case the education department that cover the education unit should conduct a continuous and structured guidance as well as motivation to the education stakeholders to increase character values that are running low in almost all levels.

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Market-oriented Agri-Technology and Agri-Extension Services for Agrarian Reform Community Connectivity and Economic Support Services (ARCCESS) for Isabela

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***Abstract*—** *Market-oriented agri-technology and agri-extension services (AES) was conceptualized after need/design assessment. It is a component of DAR-ARCESS particularly harnessing Agrarian Reform Beneficiaries Organizations (ARBOs) to become skilled and equip with business knowledge align to the enterprise they have engaged in. Generally, this AES aims to provide trainings/technology transfer/coaching along the commodity/areas on value chain strategy for the Agrarian Reform Communities in Isabela. Specifically, it aimed to: 1) strengthen farm efficiencies and productivity of rice and corn farmers; 2) enhance rice and corn farmers' knowledge on postharvest; 3) improve value-adding activities of rice and corn farmers; 4) enrich rice and corn farmers' knowledge on Common Service Facilities operations and maintenance; and 5) establish pool of technical experts.*

There were five lead ARBOs who participated in this project classified into rice and corn based agri-enterprises. Various extension modalities were adopted to attain project objectives. Activities were highlighted by two season long training programs on rice and corn as venue for technology lectures and demonstrations. The project outcomes are: a) 39 corn and 93 rice farmers trained field technicians; b) two field exposures (Lakbay-Aral) for rice and corn to private and public agencies outside the region; c) conducted seminar-workshop on sustainability planning; and d) developed training manuals, modules, technoguide and IEC materials for both crops.

Farmers have attained greater knowledge, developed their farming skills and more confident in doing farming business. They have improved relationships, becoming closer and open minded individuals.

The lead ARBOs farm-technicians must do their share to disseminate what they have learned to other farmers constituent ARBOs. The DARPO must provide assistance to them for program development, financial and other logistics for the conduct of field extension services. The DAR must follow – up and conduct periodic evaluation to lead ARBOs for the implementation of sustainability plan.

Keywords*— *Agrarian, Agri-extension, Market Oriented, Farmers Field School, Communities.

I. INTRODUCTION

A. Project Background

The Agrarian Reform Community Connectivity and Economic Support Services (ARCCESS) Project is considered as one of the priority banner programs of the Department of Agrarian Reform to increase farm productivity, improve household incomes of Agrarian Reform Beneficiaries (ARBs) and provide sustainable livelihood through the organization of competitive agricultural enterprises initially designed to be implemented in three (3) years.

The project has two components to include: 1) the provision of Common Service Facilities and 2) the provision of Business Development Services as capability building program for the Agrarian Reform Communities (ARCs). After the Needs Assessment and Design Assessment conducted by the State University and Colleges (SUCs) as a third party evaluator, market-oriented agri-technology and agri-extension services were identified to comprise the second component of the ARCCESS Project.

B. Project Objectives

Generally, this Agricultural Extension Service (AES) aims to provide trainings/technology transfer/coaching along the commodity/areas on value chain strategy for the ARCs in Isabela. Specifically, it aims to attain the following objectives: 1) Strengthen farm efficiencies and

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productivity of rice and corn farmers thru provision of training in production technology and management, to wit: a) soil testing and fertility management, b) integrated pest management, c) organic fertilizer production, and d) farm management and planning; 2) Enhance rice and corn farmers' knowledge on postharvest technology and management; 3) Improve value-adding activities of rice and corn farmers thru implementation of training, fora, seminar on primary processing technology and management; 4) Enrich rice and corn farmers' knowledge on Common Service Facility (CSF) operations and maintenance; and, 5) Establish pool of technical experts thru training/coaching of farmer technicians thru Farmer Field School (Demo Farms).

C. Scope and Coverage of the Project

The scope of the AES Isabela Lot includes the five sub-projects on the first phase of ARCCESS Project implementation. Focus of the AES interventions are on the production side of the agrarian reform communities.

These sub-projects include the following lead Agrarian Reform Beneficiaries Organizations (ARBOs), Constituent ARBOs and locations:

	Lead ARBO	Constituent ARBO/s	Location
1.	North Siffu Farmers' Multipurpose Cooperative	Malaya Development Cooperative	Roxas, Isabela
2.	D4 Series Confederation of Irrigators Association (CIA)	None	Cauayan City, Isabela
3.	Bannawing Farmers' Multipurpose Cooperative	MBSS Multipurpose Cooperative	Jones, Isabela
4.	Lapogan Multipurpose Cooperative	St. Elizabeth Auto Savings Group San Francisco Kababaihan Auto Savings Group San Rafael Kababaihan Auto Savings Group Sta. Maria Kababaihan Auto Savings Group	Tumauini, Isabela
5.	Villacabanes Credit Cooperative	NDC 8 CIA Namnama Irrigators' Association	San Manuel, Isabela

D. Conceptual Framework

The IPO explains the framework of the study wherein the DAR-ARCCESS Agri-Extension Support Services would be the main input for the development of participating ARBOs. The core team from the Isabela State University implemented different modalities such as Business Planning, Training, Lakbay Aral and Information, Education and Communication (IEC) materials development to come up the expected output as indicated in Figure 1.

Fig.1: Conceptual Framework of the Study

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II. PROJECT METHODOLOGY OF IMPLEMENTATION

A. Selection of ARBOs

The lead ARBOs were selected by DAR as recipient of ARCESS project of the department. They were evaluated and selected by the core team based on resources, personnel structure, truck record, and capabilities to manage the CSF awarded to them.

B. Locale, Time and Participating Organizations

The project was implemented from September 2013 to December 2015 to lead ARBOs in rice and corn communities in 4 districts of Isabela. For rice ARBOs communities are North Siffu Farmers' Multipurpose Cooperative (NSFMC), Roxas in district 1; Villa Cabanes Credit Cooperative (VCCC), San Manuel in district 2; and D4 Series Council of Irrigators' Association (D4SCIA), Cauayan in district 3; while for corn ARBOs communities are Bannawing Farmers' Multipurpose Cooperative (BFMC), Jones in district 4 and Lapogan Multipurpose Cooperative (LMC), Tumauini in district 1 of Isabela as shown in Figure 2.

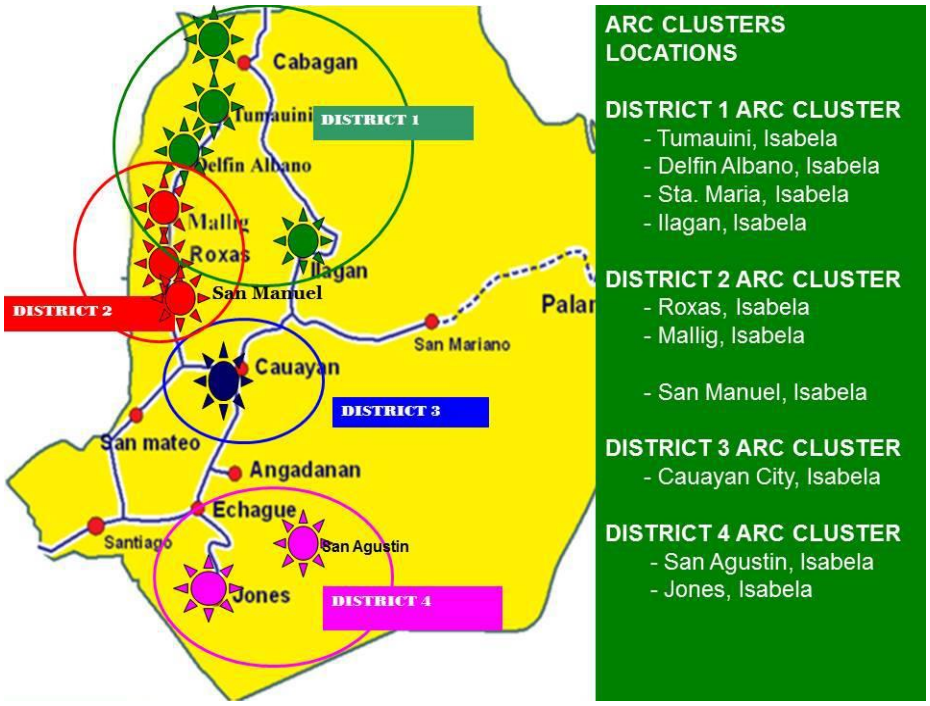

Fig.2: Location map of the DAR-ARCESS AES project

C. Extension Modalities Adopted by the Project

1. Conduct of review of the Needs and Design Assessment of the five ARBOs – Inception Meeting Activity. This is the first step in the identification of interventions for the ARBOs under the AES project. Prior to project implementation of the ARCCESS Project is the contracted activity on Needs and Design Assessment (NADA) of the sub-projects included in the AES. During the Inception meeting, project activities based on the reviewed needs were firmed up.

2. ***Development of Strategic Operational Plans.*** One of the focused of the AES is the provision of technical assistance in the ARBOs development of strategic operational plans such as the CSF Business Plans, Farm Production, Management Plans and Sustainability Plans.

With the provided Common Service Facilities as the springboard for the AES implementation, this banks on the idea of providing farm machineries to improve the production of farmers from manual to mechanized production and for the ARBOs which are mostly cooperatives to have additional income from rents of the agri machineries. The CSF business plans and manuals were developed through the assistance of Isabela State University (ISU) Agribusiness experts for the ARBOs to have targets and directions in earning income from the CSFs. The farm production and management plans were developed to improve the farm management techniques of the ARBs. Through the plan, appropriate budgeting and target setting in their agricultural production activities.

It is hoped that through these plans, together with the coaching and mentoring activities, the ARBs will have the consciousness to look at the CSFs as a business enterprise and agricultural production as a business activity.

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3. Conduct of Trainings (Season-long training and Need-based trainings).The conducted trainings for the AES came in two forms, as a result of making the interventions need-based and site specific. Two sets of training approaches were implemented to include the season-long training which is conducted for rice and the trainings on specific technologies.

The trainings catered to the needs of the pre-identified 25 ARBO technicians from the five ARBOs in complementary with the establishment of technology demonstrations farms on rice and corn.

This activity was implemented as part of the objective and expected output of training 25 farmer-technicians per ARBO who shall serve as catalyst for future coaching and mentoring in the ARCs with respect on rice and corn production.

4. Development and Dissemination of IEC Materials.The conducted trainings were supported/reinforced by the production of information, education and communication materials in the form of flyers, techno guides, manuals and other printed materials. Media preferences of farmers were defined based on the needs assessment conducted. Developed IECs underwent pre-testing with the ARBs.

5. *Conduct of Lakbay Aral.*The conduct of appreciation tours at successful farmers was made as reinforcements on the lecture series and trainings implemented at the ARBO communities. In here, the farmers learned the technologies but also emulate values from successful individuals in farming business.

6. Conduct of coaching and mentoring sessions.Specific needs of the ARBs were answered during the coaching and mentoring activities during field visits in the areas.

7. Establishment of technology demonstration farms on rice and corn productions.The establishment of Farmer Field School (FFS) Demo Farm complemented the lecture series implemented as part of the capability development of the rice and corn farmers.

8. *Monitoring and Evaluation Activities.* Monitoring activities were implemented at the ARBOs level to gauge the extent of project implementation as well as to identify problems which affects implementation.

III. PROJECT RESULTS AND DISCUSSION

A. Information About the ARBOs Assisted

1. Corn ARBOs Community

Name of ARBO	**Bannawing Farmers' Multipurpose Cooperative (BFMC)**
Type of Crop	Corn
ARBOs Assisted	Mapalad-Bautista-Sto. Nino-Sto. Domingo Marketing Cooperative
Location	Jones and san Agustin, Isabela
Name of ARBO	**Lapogan Multipurpose Cooperative (LMC)**
Type of Crop	Corn
ARBOs Assisted	- St. Elizabeth Auto Savings Group - Sta. Maria Kababaihan Auto Savings Group - San Francisco Kababaihan Auto Savings Group - San Rafael Kababaihan Auto Savings Group
Location	Tumauini and Ilagan City, Isabela

2. Rice ARBOs Community

Name of ARBO	**North Siffu Farmers' Multipurpose Cooperative (NSFMC)**
Type of Crop	Rice
ARBOs Assisted	Malaya Development Cooperative
Location	Mallig and Roxas, Isabela
Name of ARBO	**D4 Series Council of Irrigators' Association (D4SCIA)**
Type of Crop	Rice

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ARBOs Assisted	Same (single ARBO sub-project)
Location	Cauayan City, Isabela
Name of ARBO	**Villa Cabanes Credit Cooperative (VCCC)**
Type of Crop	Rice
ARBOs Assisted	- Namnama Irrigators' Association - NDC 8 CIA
Location	San Manuel, Isabela

B. Background and Context of Sub-projects being Covered

1. Sub-Project Title: Provision of Business Development Service and Common Service Facilities (Machineries). Area: Jones and San Agustin, Isabela

ARCCESS Project Jones-San Agustin Cluster on a flat to slightly rolling fertile land and largely along riverbanks. Corn is the main product in the area. Cornfields in the cluster are generally dependent on rainfall as source of irrigation water. Others use open-source pumps to irrigate their cornfields. Industry in the area is agri-based with very limited farm, off-farm and non-farm livelihood opportunities available among the target beneficiaries and non-beneficiaries as well.

Corn is the major crop planted in the sub-project's service areas. Total land area covered by the Bannawing Farmers' MPC totaled to 355.60 hectares. Average farm size of members is pegged at 2.80 hectares with average production of members at 11.20 metric tons per hectare. On the other hand, the Mapalad-Bautista-San Antonio-Sto Niño Marketing Cooperative has rice, corn, cassava and carabao milk as their major commodities. Total area covered by the ARBO is pegged at 519 hectares with average farm size of members at 3 hectares. Average production of members for rice is at 4 metric tons per hectare per cropping, corn is pegged at 0.5 metric tons per hectare per cropping, cassava is at 0.8 tons/hectare per cropping and milk production pegged at 2-3 liters per day.

2. Sub-Project Title: Kita sa MaisanAtingPalakasin. Area: Tumauini and Ilagan City, Isabela

In the context of the sub project which is focused on corn, the areas are generally crop producing areas implementing mono-cropping pattern in two cropping seasons. Majority of the areas are rainfed and farms are located in river vegas to rolling hills. Soil is generally characterized by sandy loam soil suitable for corn production. These areas are considered to be major corn-producing areas.

The sub-project cuts across three municipalities in the province to include Tumauini, where the lead ARBO is located. Lapogan MPC has rice and corn as their major crops. Total land area planted to corn corresponds to 239.40 hectares while rice accounts to 120 hectares. Average farm size of members consists of 1.5 hectares for corn and 0.79 hectare for rice. Average production of members for corn in the area accounts to 6.34 metric tons while 5.06 metric tons for rice. Ilagan City is one of the areas under the sub-project. All of the ARBOs included in the cluster are four (4) Women Auto Savings Groups (ASGs). The St. Elizabeth ASG has rice, corn and tobacco as major cash crops. Total land area of the ARBO accounts to 945.12 hectares. Average corn farm size of farmers corresponds to 0.5 hectare with average production of 4.5 metric tons per cropping per hectare. The San Francisco KababaihanASG has corn as its major crop. Total land area accounts to 248.67 hectares. Average farm size of members is 1.50 hectares with average corn production of 5 metric tons. Corn and peanut are the major commodities of the Sta. Maria ASG. The total area of the ARBO accounts to 104.80 hectares. Average farm size of members is pegged at 1.20 hectares with average production of 5 metric tons per hectare. Lastly, the San Rafael KababaihanASG has corn, rice and peanuts as their commodities. Total area covered by the ARBO is pegged at 359.51 hectares. Average farm size of members is placed at 1.65 hectares with average production of 5 metric tons per hectare.

The landscape of the sub-projectis composed of non-irrigated flatlands. Cornfields in the cluster are dependent on rainfall as source of irrigation water. Others use open-source pumps to irrigate their cornfields. The farm production technology used in the area is a combination of labor and mechanized production system. Land preparation of corn fields is done with tractors/mechanized preparation coupled with labor-based/manual planting, fertilization is done manually, as well as weeding with the use of draft animals. Harvesting is done manually. The ARBOs use threshers during harvesting. Tractors, pavements, kuliglig, trailers, water pumps, storage facilities (kamaligs) and hauling trucks are present in the locality. Very limited livelihood opportunities are available among the target beneficiaries specially the KababaihanASGs.

3. Sub-Project Title: Provision of Common Pre and Post Harvest Facilities Cum Seed Capital (Rice). Area: Mallig and Roxas, Isabela

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The area of the sub-project composed of irrigated rice fields, which are generally irrigated flatlands. The landscape of ARCCESSRoxas-Mallig Cluster is relatively composed of flatlands with minimal rise at certain point with base mountain elevations on the eastern part. Other parts of the cluster can be described as low-lying hills with rolling terrain with an elevation of 200 feet or 61 meters above sea level. The cluster is dissected by creeks, rivers and waterways acting as natural drainage from waters coming from the uplands. The *Siffu River* and Magat River supply the rice fields in the cluster with irrigation. In this ARCCESS Project cluster, rice is the predominant crop, planted twice a year. In the service area of the proposed project corn is also planted. Livelihood opportunities among the target beneficiaries are limited to on-farm and off-farm activities in rice and corn farming.

The sub-project is composed of two (2) ARBOs from the municipalities of Roxas and Mallig. North SiffuMPC is the lead ARBO with palay, corn and vegetable as their major commodities. Total area covered corresponds to 650 hectares with average farm size of members' accounts to 2 hectares with average production of 5.5 metric tons per hectare. On the other hand, the Malaya Development Cooperative has rice and diary as its major commodities. Total area covered is 2,506 hectares with average farm size of members accounting to two (2) hectares with average production of 4.5 metric tons per hectare.

The farm production technology used in the area is a combination of labor and mechanized production system. Land preparation of corn fields is done with tractors/mechanized preparation coupled with labor-based/manual planting, fertilization is done manually, as well as weeding with the use of draft animals. Harvesting is done manually. The ARBOs use threshers during harvesting. Tractors, pavements, kuliglig, trailers, water pumps, storage facilities (kamaligs) and hauling trucks are present in the locality.

4. ***Sub-Project Title: Council of Irrigators Mechanized Rice Production. Area: Cauayan City, Isabela***

ARCESS Project MINAGMARCO ARC Cluster lies on a flat fertile land of Isabela. The landscape of ARCESS Project MINAGMARCO ARC Cluster is composed of irrigated flatlands. The Magatriver (through the Magat Dam supply the rice fields in the cluster with irrigation. In this ARCESS Project cluster, rice is the main crop, planted twice a year. Mono cropping is practiced.

MINAGMARCO ARC Cluster areas are generally rice producing areas. Total area covered is 2000.9277 hectares with average farm size of members at 1.3 hectares with 5.85 metric tons per hectare as average production of members. Considerably, the production system of MINAGMARCO is highly mechanized, wherein, land preparation is done with tractors (kuliglig) and harvesting is done with combine reaper-harvester. Fertilization is done using manual labor.

The Council of Irrigators Association (CIA) showed good financial position in their operation particularly in year 2009 and 2010. They have increased total assets in 2010 with Php 5,952,424.13 as compared to year 2009 with Php 3,125,134.92.

5. ***Sub-Project Title: Provision of Business Development and Common Service Facilities for Rice. Area: San Manuel, Isabela***

The landscape of ARCESS Project San Manuel is composed of irrigated flatlands.The dominant cropping pattern is rice-rice. The farmers are mostly Agrarian Reform Beneficiaries. Though near the Magat River and the area receives irrigation from it, the IA-member ARBO of the cluster depended largely on rain water as source of irrigation for their rice fields. Others use open-source pumps to irrigate their ricefields. Very limited livelihood opportunities are available among the target beneficiaries.

The sub-project consists of three (3) ARBOs in the municipality of San Manuel. Rice is the major commodity planted. Villacabanes Credit Cooperative has total area coverage of 115.98 hectares. Average farm size of members is pegged at 1.81 hectares with average production of members at 9.8 metric tons. Namnama Irrigators Association on the other hand has 72 hectares of total area covered. Average farm size of members is pegged at 2.05 hectares with average production of members at 10.8 tons per cropping per hectare. The North Diversion Canal 8 Council of Irrigators Association (NDC 8 CIA) has 1,374 hectares of total land area. Average farm size of members is pegged at 1.43 hectares with average production of members at 7.5 tons per cropping per hectare.

C. Technical Persons in Project Implementation

1. Organizational Structure

Figure 3 shows the organizational structure of AES technical working group. The project team was staffed with different as indicated in the organizational setup. They were coming from main campus of the Isabela State University at Echague, Isabela.

2. Technical/Managerial Staff

a. **PEDRITA N. MEDRANO** - Project Coordinator/ Technology Transfer Specialist. She is responsible to: 1) oversee overall project implementation; 2) heads the management team; 3) review and suggest improvement of training modules; 4) coordinate/Liaise with the management team and DAR; 5) monitor and evaluate project implementation; and 6) prepares progress report and submit to DAR.

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b. **VANESSA V. CARRIEDO**- Asst. Project Coordinator/ IEC Development Specialist. She is task to do the following: 1) assist the project coordinator in overall implementation; 2) manages the production, development, prototyping and dissemination of IEC materials; 3) review of training modules/concepts; 4) in coordination with the Training Specialist, conduct information and needs assessment; 5) coordinate and facilitate conduct of trainings/coaching/ mentoring activities; 6) prepare reports; and 7) do other activities mandated by the project leader in relation to project implementation.

c. **ALBERTO R. DOMINGO** - Economic Development Specialist. His tasks are: 1) Prepares training design along economic development of the ARBOs (business plan making, CSF business plan and scheduling); 2) Lead in the identification of resource persons, preparation of logistics and others; 3) assist in the conduct of the trainings; 4) prepare activity report after trainings; and, 5) do other activities mandated by the project leader in relation to project implementation.

d. **LUZVIMINDA L. DOMINGO** - Community Organizing and Training Specialist.She is assigned to: 1) oversee preparation of all training modules; 2) lead the conduct of trainings and other technology transfer activities; 3) conduct regular monitoring and evaluation of trainings conducted; and, 4) do other activities mandated by the project leader in relation to project implementation.

e. **DIOSDADO C. CAÑETE** - Agri business Development Specialist. His tasks are: 1) prepares training design along agri-business development of the ARBOs (farm management, planning and others); 2) lead in the identification of resource persons, preparation of logistics and others; 3) assist in the conduct of the trainings; 4) prepare activity report after trainings; and, 5) do other activities mandated by the project leader in relation to project implementation.

f. Consultants (on an on-call basis). Table 1 shows the list of on-call experts as consultants of the project indicating their position and expertise.

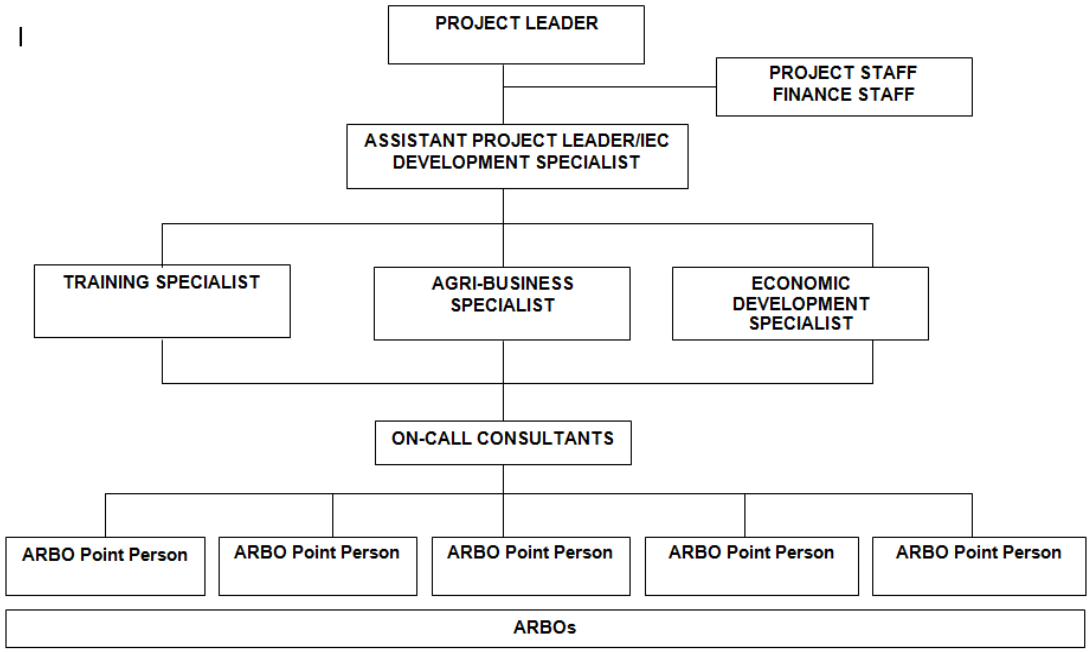

Fig.3: Organizational Structure of Project Core Team

D. Project Inception Meeting

The inception meeting was conducted on August 7, 2013 at Biazon Hostel, Isabela State University, Echague, Isabela. Representative from the lead ARBOs in the sub projects are invited composed of the following: Chairman, President/Manager, Accountant, and five members from the various service areas of the ARBO. Representatives from the ARBOs in the cluster are also invited together with the Department of Agrarian Reform Provincial Office - Barangay Development Council Department (DARPO-BDCD) representatives. The third party project progress monitoring and evaluation representative was also present during the inception meeting.

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Table.1: Nature, task and position/expertise of on call experts of the project

Nature of Task	Position/expertise	Task
One (1) Soils Expert One (1) IPM Expert One (1) Organic Fertilizer Production Expert One (1) Post Harvest Management Expert One (1) Food Technologist One (1) CSF Expert One (1) Farm Management Expert 12 Experts for the 12 modules on Season Long Rice Production Technology 12 experts for the 12 modules on Season Long Corn Production Technology	Soils Expert IPM Expert Organic Fertilizer Production Expert Postharvest Management Expert Food Technologist Farm Management Expert 12 Experts for the 12 modules for Season Long Rice Production Technology 12 experts for the 12 modules for Season Long Corn Production Technology	• Serve as resource speakers on the identified areas for training conduct. • Provide recommendations on existing practices of rice and corn farmers.

The project team divided the inception meeting into three (3) parts. First is the presentation of the NADA results of the sub-projects. The project team saw this as an important part of the inception meeting as a stepping stone of the AES implementation. It should be noted that the ISU Project Team was also the group of evaluators who conducted the NADA of the sub-projects. Second is the presentation of the Personal Entrepreneurial Competencies of the ARBOs. Considering that the ARCCESS Project is towards implementation of an agri-enterprise, it is important that the ARBOs could see their entrepreneurial competencies. These first two parts serve as feed backing activity with the ARBOs on the NADA results. Third part is the presentation of the project brief followed by the levelling of expectations and open forum with the ARBO representatives.

The following are the highlights of the conducted inception meeting with the ARBOs:

Presentation of the NADA results

Ms. Carriedo, Project Staff, presented the NADA results to the ARBO representatives. Particularly she provided focused on the training needs, CSF needs vs. CSF proposed in the ARCCESS project, recommendations from the ISU Evaluation team. (please see attached presentation). After the presentation, Ms. Carriedo asked the group if the presented results (CSFs and agricultural needs) are still prevailing in the communities. The group answered yes, with some comments on the awarded CSFs.

The Chairman of the Lapogan MPC expressed that the CSF provided to them are not suited to their needs, as the corn thresher provided to them requires de husking first before threshing. The technology according to him does not suit the existing production technologies implemented in their fields. DARPO representative, Ms. Loret Gaspar answered that such had been the problem of the first phase, since the bidding process was made at DAR Central Office. Also, according to her, the lack of specifications made the bidding process acquire the threshers from Cebu. She added that the problem was answered for the second phase of ARCCESS Project, as bidding will be done at the regional level with complete specifications.

The D4 Series CIA also expressed concern on the specification of the tractor given as he said that such could have been better if the specification a 90 horse power tractor, compared to the 35 horse power engine provided. This is seconded by the North Siffu Farmers' MPC. Ms. Loret answered that the ARBOs should maximize the utilization of the awarded machineries. According to her, the ARBOs could buy a new one from the income of the CSFs. All the ARBOs agreed. The North SiffuMPC said that they now have Php200,000 income out of the rentals of their CSFs.

Personal Entrepreneurial Competencies

Dr. Luzviminda Domingo presented the result of the PEC scores obtained during the NADA. In general, the ARBOs have low entrepreneurial competencies. The ARBOs asked if they could still improve on their competencies. Dr. Domingo answered yes and suggested conduct of trainings along the matter.

ARCESS-AES Project Brief

Dr. Pedrita N. Medrano, Project Leader presented the ARCCESS-AES Project Brief. She presented the objectives, activities, expected outputs and terms of engagements with the ARBOs along project implementation. During the plenary session, one of the raised concerns is on the season long training of 25 farmer-technicians from each of the lead ARBOs by sub-project. Lapogan MPC said that they cannot provide the

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pre-identified in the project. Suggestion from the group is that Lapogan MPC could tap/get other farmer-trainers from the other ARBOs in the cluster. It was agreed upon by the ARBOs. Also, one of the concerns in the season-long training is ID there is a set criteria for the identification of the farmers.

Making the approach participatory, the team asked the ARBOs on what should be the criteria/qualities of the farmers who should undergo training. One of the representatives said that the farmer should have the commitment to finish and share the knowledge that he/she could gain out of the training. Also, they said that he/she should have a farm, since not all of the members of the ARBOs have farm fields. With the initial inputs from the ARBOs, the ISU Project Team presented the proposed list of criteria in the selection of farmers for the season-long training for validation. The criteria are as follows: 1) commitment to coach (willingness to share/serve other members of the ARBOs as a technician), 2) must have a farm and willing to share/use farm in coaching/mentoring of other farmers, 3) all ARBOs included in one sub-project should have at least one (1) representative in the training, so that all member ARBOs of the cluster will be represented), 4) couples are not allowed to attend the trainings. Only one of them should attend the training, and 5) physically and mentally fit regardless of age to undergo training.

The list of criteria was validated and accepted for implementation by the ARBOs. The ARBOs also agreed that the season-long training and the establishment of a demo farm will be conducted at Isabela State University, considering the facilities and resources available in the university. The season-long training will be conducted using the German Dual-Tech approach wherein lecture will be followed immediately by hands-on application. The ARBOs also suggested on the presented contents of the trainings to include specifically the dapog establishment. It was also agreed upon by the stakeholders that the training schedule will follow the planting calendar. The ARBOs agreed to submit the names of the farmers who will attend the training on or before August 14, 2013.

Another concern raised by the ARBOs is the transportation cost of going to ISU during trainings. The ISU Project Team answered that they can write the Local Government Units (LGUs) to shoulder the transportation cost of the farmers to and fro during the training, while meals of the farmer-trainees will be charged against the ARCCESS-AES Project fund. Dr. Medrano said that such approach was implemented and proved to be applicable and working during the recently concluded SM Foundation and Har Best Training on High Value Commercial Crops. The stakeholders agreed that ISU will write the LGUs for the said request.

Season Long Training

During the consultation, on the part of the 25 farmer-technician, the ARBOs signified their concern on the fact that they cannot readily provide the identified list. With this, it is suggested that the methodology of identifying the 25 farmers be changed and should not be confined within the lead ARBO members. As such, the following changes in the methodology will be incorporated in the project work plan: a) the 25 farmers who will attend the season-long training will not only come from the lead ARBO, whilst, a minimum of one representative from the other members of the cluster ARBOs within the sub-project will be included; b) the criteria in identifying the 25 farmer-trainees will be employed; and c) ISU will serve as the training venue for the season-long training for rice, while for corn season training at BannawingMPCI.

Also, there is a change in the schedule of project implementation. Based on bid documents, July should be the start of project implementation, though the problem of common schedule impeded the conduct of the inception meeting. With this, the ISU project team will implement the season-long training for second cropping while conducting the CSF Business Planning cum Training-Workshop for August and September.

Considering that the project will implement a season-long training, another change in the methodology is the integration of previously identified individual trainings into the season long trainings. As per consultation, the ARBOs would like to have an integrated and continuous training course on the production technologies composed of the modules from the pre-identified individual trainings.

E. Farmer Field School (FFS)

1. Identify FFS Study Site

On corn FFS were conducted in separate sites due to the distance of the two ARBOs. BannawingMPC was on site lecture and establishment of techno demo farm. Aside from on call experts who conducted lectures on site on his/her technical expertise, one specialist on corn production from the DA-LGU technician in Jones was assigned to lecture other technologies, establishment and monitor the operation of corn techno demo farm. On the other hand, Lapogan Multipurpose Cooperative was conducted their FFS based on the needed technologies that they want to learn. The trainings were conducted at different sites where the expertise and facilities are located like farm planning was conducted in Isabela State University; soil analysis and fertility management, pest

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and diseases control, and postharvest management were conducted at DA-CVRC, Ilagan.

For rice FFS which involving for three (3) ARBOs such as North Zifu, Villa CavanesMPCI and D4 Series CIA was strategizing also its lecture and technical demonstration based on the location of expertise and facilities. Due to unavailability of demo farm area, proximate distance from among them and persons that will monitor and safeguard the demo farm while not on session the group decided to have it in ISU Echague. Among the agencies tapped by the core team to facilitate the FFS were DA-ATI, DA-CVRC and ISU.

2. Name and qualification of facilitator for the FFS

To facilitate the FFS both rice and corn in order to achieve the set forth objectives, the core team tapped a specialist/experts on specific technology on rice and corn production in the university and consortium agencies like DA-ATI and CVRC. Remedial classes were also undertaken for the ARBOs who want to know topics that can help them increase income like engaging entrepreneurial activities aside from farming. The following are the facilitators, lecturers during the FFS-Corn and Rice as indicated in Table 2.

3. Details on the Curriculum Developed

a. Corn Season Long Training

As conducted, the curriculum implemented followed the "Agro-Ecosystems Approach" or AESA. The Lead Resource Person, Mr. German Cabudol (DA Agricultural Technologist of Jones, Isabela) and ISU TEAM agreed and as implemented, sessions were started from Farm Planning and Budgeting/Seed selection/ Land Preparation, integrated nutrient management, soil testing and analysis (use of BIO-N included), Natural Farm Inputs, integrated pest management, harvesting technology, post-harvest technology, up to storage and marketing.

Table.2: List of experts lecturers of the two season long training programs of the AES project

Corn Season Long		Rice Season Long	
German Cabudol	DA-LGU-Jones Corn Expert	Prof. Teodoro Agtunong	Crop Science/Plant Breeding
Minda Flor Aquino	DA-Region 02 Corn Expert	Dr. Evalyn Rose Romero	Agri-business Management
SeverinoTumamang	DA-CVRC Corn Expert	Mr. Jose Felipe Romero	Environmental Science
LeodeliaBabaran	DA-CVRC Corn Expert	Dr. William Gabriel	Crop Science
Dr. DemocritoRebong	Plant Breeding	Dr. JuanitoAtiwag	Soils Expert
Engr. ArlinaGolonan	Agricultural Engineering	Mr. Stanley Pastor	Farm Machinery
Prof. Nelson Sotelo	Agronomy/Crop Science	Dr. Lucila Rocha	Crop Water Management
Dr. VisitacionDacuycuy	Crop Science	Ms. Gracia Amar	Plant Pathologist
		Jean Mirandilla	Soil Science

The lecturers for Remedial Classes:

Dr. Francis Baleta and Dr. Imelda Lucero – Fisheries/Aquaculture

As planned agreed by ARBO Officers/members and Season Long Training (SLT) participants and ISU Team, Season Long Training sessions was conducted once-a-week (every Wednesday or as announced by the resource person).

A field visit by the farmers on the demo site was conducted before their class every Wednesday, usually at 6:00 am. The AESA was conducted during said time and results were presented by group before a lecture was given by the expert.

In a consultation meeting conducted by ISU TEAM in Lapogan MPC, the modules included in the Catch-up Plan were as follows: a) Integrated Nutrient Management, b) Integrated Pest Management, c) Open Pollinated Variety Corn Seed Production, d) Other Corn Production Technologies, and e) Other Technologies like Vermicomposting Technologies. Experts of DA-CVRC were tapped as resource persons.

b. For Rice Season Long Training

The FFS (season-long training) being developed is based on the training needs of the ARBO with some modifications made during the actual conduct of the training. The training was done at Department of Agriculture – Agriculture Technical Institute (DA-ATI) San Mateo, Isabela where the Resource Persons or experts and most of the facilitators came from the PHILRICE.

The curriculum which is a season-long training integrates experiential learning theory where the farmer-participants learned by actual doing. This was done when farmers

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went to the rice demo field areas where they actually conducted hands on demo preparation of the Minus One Element Technique (MOET) supervised and facilitated by the researchers from PHILRICE. The MOET is integrated in the module on Integrated Nutrient Management. For the Integrated Pests Management module, the trainees collected some samples of the pests and diseases in the demonstration farm site which were then identified and classified by them. They presented their outputs during the group presentation. By doing so, the farmer-trainees can apply their learned lessons and knowledge acquired from the lectures and then applied to the actual field. This approach was selected because of the following reasons: a) knowledge acquired by the trainees from the lectures will be applied in the field; b) the approach serves as a feedback or a M & E mechanism where the Resource Person can determine whether there are gaps in the lectures, hence, reinforcement lectures can be done; c) the participants can evaluate by themselves if they need to further learn the lesson or topic given to them. With this reasons, the German Dual Tech System of Training suits the Season Long Training.

Information derived from the survey provided the project team a notion on the topics which needs to be given emphasis and what not. This way the lectures and hands-on activities were need-based.

4. Pre-KSA Measurement Tools

a. Corn ARBOs Community

Knowledge, skills and Attitudes that need to be improved by core group members.

Based on survey, the Bannawing FMC needs to improve on their technical know-how on producing corn. Farm planning and budgeting is also deemed needed as well as the need to improve the entrepreneurial competencies of the ARBO members.

In Lapogan MPC and its women ASG cluster members need to improve on their technical know-how on producing corn. Farm planning and budgeting is also deemed needed as well as the need to improve the entrepreneurial competencies of the ARBO members. Added component technologies such as vermicomposting and production of open-pollinated variety corn seed were identified and were included in the catch up plan.

Tools for administering pre-KSA survey.

Group consultations were conducted as well as a survey form was used to determine the specific individual training needs of farmers. This provided a glimpse of the technical knowledge of the farmers on the trainings to be conducted.

Details on the result of the pre-KSA survey.

There are a total of 25 participants in the Technology and Information Needs Assessment conducted in BannawingMPCI. Technical knowledge on corn production is one of the identified KSA needed by the ARBOs based on the survey result particularly on integrated pest management.

In Lapogan MPC, there are a total of 25 participants in the Technology and Information Needs Assessment. Majority of the respondents are within the age of 36 to 50 years old, with landholdings averaging to 0.5 to 2 hectares. Technical knowledge on corn production is one of the identified KSA needed by the ARBOs based on the survey result.

b. Rice ARBOs Community

Knowledge, skills and attitudes that need to be improved by core group members.

This process of identifying the KSA of the group members is completed through the Technology Need Assessment (TNA0 conducted. Results showed that ARBO members of North SiffuFMPC, D4 Series CIA and VCC need to improve their technical know-how on the commodity production. This result validated the result of the NADA wherein, technical knowledge on rice production technologies specifically on the use of the CSF is one of the major concerns. The issue of how to integrate and assimilate the technical knowledge is one of the KSA which needs to be addressed. Farm planning and budgeting is one of the KSA that is found to be wanting among the ARBO members.

Tools for administering pre-KSA survey.

Group consultations are conducted as well as a survey form is used to determine the specific individual training needs of farmers. A pre-test questionnaire will also be used before the start of every training module. This will provide a glimpse of the technical knowledge of the farmers on the trainings to be conducted.

Details on the result of the pre-KSA survey.

Based from the data gathered, the farmer–enrollees identified the lack of technical knowledge in rice farming as their prime weakness in their rice production. Clearly from the identified training needs, the farmers need to undergo the season long training for rice to answer for their need on technical assistance on rice production.

5. Post-KSA Measurement Tools

a. Improvements in knowledge, skills and attitude by core group members.

The attendees derived added technological information on integrated nutrient and pest management. Accordingly, they derived knowledge on the use of natural enemies of corn and exhibited positive attitude on the use of these bio pesticides. Skills on preparing a vermicompost pit as well

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as proper management techniques were also acquired by the farmers as an add-on feature of the SLT.

b. Tools for administering post-KSA survey.

Hands-on demonstration on the application of theories discussed was conducted during the trainings as seen in the demonstration site through the Agro Ecosystem Analysis (AESA). It made used of presentation of findings and applying the theories.

c. Details on the result of the post-KSA survey.

Skill on vermicomposting technology is evidently acquired as the farmers demonstrated their knowledge gained during the hands-on activity. Positive view on the use of INM and IPM implementation was also evident as the farmers signified intention to utilize said technologies with the end view of lower production cost and as a healthy production option.

6. Follow-up

The FFS facilitators served as the conduits of the farmers with the experts. Documentation on the implementation of the FFS activities was done. Coaching and mentoring by ISU TEAM in topics of interest of participants.

F. General Assessment of each sub-project in the contracted lot

1. Bannawing Farmers' Multipurpose Cooperative. The Bannawing Farmers Multipurpose Cooperative is peculiar among the ARBOs served in terms of geographical setting, and communication access, which could be attributed to the exhibited strong group cohesion of the officers and members. Considerably, it is the farthest service area of the project.

The AES interventions specifically on the provision of season-long trainings were conducted in collaboration with the Local Government Unit of Jones, Isabela. The approach implemented was the AESA. This approach was complemented by the establishment of a demonstration farm in the vicinity. With this setup, the participation from the trainees registered a complete attendance as well as exceeded the target of 25 farmers to an actual number of 31. Field visit, harvest festival and graduation were also conducted as culmination activities for the trainings conducted.

Coaching and mentoring activities were conducted onsite. Through these activities, constant advice on how to make the common service facilities (CSFs) profitable was also imparted. Added technologies on organic fertilizer production were also provided to the ARBO members. These technologies serve double purpose as they serve as part of the production technologies alternative to synthetic fertilizer, as well as potential source of income.

A technoguide on corn production was also provided. Flyers on the add-on technologies were also developed and disseminated. The ARBO also established a vermi-compost production area in their barangay. One problem encountered in this sub project is the technical problem encountered by the sub-project on their CSF machineries. The conducted Lakbay Aral provided insights for the ARBO members.

Across project interventions implemented, gender balance is very prevalent. Considerably, at the onset of project implementation, the ARBO somehow lacks the needed business mindedness required in managing an agri-business enterprise. Significantly, after project implementation, the interventions changed their perspectives on their facilities and developing an entrepreneurship mind. With this changed values and mind set, the ARBO still need continuous coaching activity to further develop their entrepreneurial capacities. This will complement the improved managerial capacity of the ARBO in handling the cooperative operation. Based on the assessment conducted, the ARBOs still yet to establish a full scale cooperative operation on a day-to-day basis. The ability of the ARBO to learn from other ARBOs within the project helps them to innovate and improve their operation.

2. Lapogan MPC. The Lapogan Multipurpose Cooperative is one of the experienced ARBOs in the AES Isabela Lot. It has experience on producing and marketing BIO-N. The production stopped since they lack adequate market for their BIO-N. The cooperative has an existing office and other infrastructures such as the drying pavement, tractor and a storage facility. The ARBO has a long standing reputation as a cooperative.

It is peculiar with the ARBOs since they still have not received their CSF machineries under the ARCESS Project. It is a known fact since the start of the AES project that the corn sheller provided to the ARBO is not applicable to the current production system of the community. With this, the ARBO has no CSF operation at present.

Trainings were conducted on a need-based basis. In consultation with the ARBO, a set of trainings particularly on fertilization management, pest and diseases management were conducted in collaboration with the Department of Agriculture – Cagayan Valley Research Center (DA-CVRC) in Ilagan, Isabela. A technology demonstration farm was not established for the ARBO since the project duration does not permit the intervention since it was too late then for the activity. The farmers participated well in the conducted trainings. IEC materials were also developed for the ARBO.

In the conduct of the interventions, especially on the trainings conducted, the ARBO showed exceptional

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technology-orientation. The specific technologies provided to them complemented their existing corn production practices. The ARBO also established a vermi-composting plot.

Based from the evaluation conducted after project implementation, the ARBO still has reservations since they have yet to receive the CSF component of the project. Accordingly, the trainings were used in their production but still lack the mechanization component.

3. D4 Series CIA. A unique ARBO whose income is not primarily derived on credit/multipurpose services of the organization but more on their share from Irrigation Service Fees from National Irrigation Administration (NIA).

Project interventions include the conduct of season-long training on rice production and the establishment of rice technology demonstration. The German Dual Tech system was implemented in the season-long training. Technology interventions on soil testing and analysis, IPM integration and use of mechanized system in rice production were the focus of the season-long training. A total of 27 farmers completed the training and graduated as farmer-technicians. Reinforcement trainings were conducted particularly on the integration of technologies as livelihood options for the ARBOs. These include the conduct of training on rice-fish culture, and organic fertilizer production.

At the onset of project implementation, analysis result to low entrepreneurial competencies of the CIA. The development of the CSF Business Plan opened the minds of the CIA to make business out of the provided machineries. As of date, they are integrating the services of the CSFs as a business enterprise, but still wanting, which is why continuous coaching and mentoring activity should be implemented.

After project implementation, the CIA is now willing to use organic fertilizer in their production considering that lowland/irrigated rice production is dominantly inorganic in production.

4. North Siffu Farmers' Multipurpose Cooperative. The North Siffu Farmers' Multipurpose Cooperative has a business-minded attitude when it comes to managing the Common Service Facilities (CSFs). As a veteran cooperative they are keen to interventions. They developed a sense of corporate identity within their community. With this, from among the five sub-projects, this cooperative has a working business, complete with office, staff, resources and other enabling factors for a business to thrive. They managed to integrate the CSF in their existing business activities.

From the trainings conducted, a total of 28 farmers attended the season-long trainings. They showed active participation in the in the different interventions provided to them. The Lakbayaral activities provided to them has provided them with knowledge on other livelihood activities.

As the officers are highly empowered, they needed to train second liners to manage the cooperative in the future. Continuous coaching and mentoring activities should be done at their level to make sure that the accomplishments of the project will be sustained.

5. **Villacabanes Credit Cooperative.** The Villacabanes Credit Cooperative is the youngest of all the ARBOs from the AES Lot Isabela. It has a strong connection with the Local Government Unit. From among the ARBOs, this ARBO requires more capability building activities.

As to AES project interventions, Villacabanes participated well in the conduct of various activities. On training, they registered a total of 27 participants. In so far as attendance, the Villacabanes Credit Cooperative has the least number of participants in the trainings conducted.

On their CSF operation, the cooperative has yet to maximize use of their machineries.

With the current situation of VCC, they have strong and capable officers which they can bank on. Though, the VCC among others, needed more coaching and mentoring activities to make the organization and its operation stronger.

G. Project Accomplishments

1. Number of farmer-technicians. Table 3 shows the number of farmer-technicians who finished the FFS curriculum.

Table.3: List of farmer-technicians who finished the FFS curriculum of the project

ARBOs	FFS Curriculum
Bannawing Farmers' Multipurpose Cooperative	31
Lapogan Multipurpose Cooperative	28
North Siffu Farmers' Multipurpose Cooperative	27
Villa Cabanes Credit Cooperative	34
D4 Series Council of Irrigators' Association	32
Total	152

2. Trainings Completed

The project completed one each season long training for rice and for corn which were participated by 93 and 31 farmers members in ARBO, respectively, one farmer-technician trainings and eight farm technicians trained.

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3. Lakbay-Aral

There were 2 Lakbay- Aral (one for Corn based Enterprise ARBOs and one for Rice based Enterprise ARBOs) conducted.

4. Sustainability Plans

On sustainability planning output are: a) validated farm production and management plan (to include proceeding and attendance of validation sessions and resolutions of ARBO Board of Directors and general assembly approving and adopting the plan) for all participating ARBOs; b) report on adoption and implementation of the Farm Production and Management Plan by farmers in their farms; c) provided component technologies as livelihood options such as training on organic fertilizer production, organic pesticide production (FPJ, FFJ, KAA, Botanical pesticides) vermicomposting; d) fourteen consultation/ coaching sessions conducted; e) Training Manual for all ARBOs; f) Twenty modules and manuals completed; g) One (1) CSF Business Plan for each Lead ARBO; h) One (1)TNA ReportDeveloped for each Lead ARBO; i) One (1) Farm Operation & Management Plan for each Lead ARBO; j) One (1) CSF Operation manual for each Lead ARBO; k) One (1) Training Manual; l) One (1) Training Proceeding; m) Thirteen (13) Training Modules; and One (1) Phase-out plan in each ARBO.

5. IECs

For IECs there were 2 IEC booklet Developed (one for rice and one for corn production); and 2Technoguide (one for rice and one for corn production).

6. Reports

The team submitted reports to DARPO and DAR Regional Office on the following: a) post evaluation report on the Farm Production and Management Plan Adoption; b) report on Training implemented with list of participants; c) post training reports of farmer technicians with document duly signed by the officers; d) Validated technoguide of commodity; e) Report on Training implemented and post training reports with list of participants; and f) coaching and mentoring reports duly signed by ARBO.

H. Stakeholders Involvement Assessment

As shown in the Table 4, there is high participation from among the stakeholders of the project which leads to its successful implementation and realization of the goals and objectives. The tasks of each stakeholder were delivered at their best on time.

Table.4: Stakeholders assessment of AES Project implementation in Isabela.

Stakeholder	**Level of involvement** ***(choose from the following list)***	**Stakeholders' influence in the current process** ***(Please rate from low to high)***	**Stakeholders' interest in the current process** ***(Please rate from low-high)***	**Feedback**
ARBOs (including members and officers, as well as households)	Co-deciding	high	high	Participatory process of project implementation
Local Government Units (thru the MAROs)	Co-producing	high	high	The LGUs are included in the training as one of the implementers through co-sharing of resources
Isabela State University	Co-producing	high	high	ISU's co-shares resources and facilities (esp. in the demo farm establishment)
DARPO - Isabela	Advising	high	high	DARPO Isabela provided needed advising and administrative support during project implementation
DAR-Region 02	Advising	High	high	DAR Regional Office provided needed advising and administrative support during project implementation

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K. Key Risks, Issues and Slippages Assessment

On risk factor assessment results of the AES, revealed very high but it was managed by implementing an appropriate strategy like intensive advocacy at the community thru imposition of training importance (Table 5). Misunderstanding among ARBOs in the cluster on the use of CSF was the main issue which is considered critical. This was resolved through the help of DARPO Isabela to make a mediation/negotiation process on ownership and utilization of CSF. The project was encountered delay implementation of of some activities but it is rated low impact since it is within the timeframe of the project. This was overcome by the team through multitasking activities during coaching sessions to keep up with the project.

Table.5: Keyrisk, Issues and Slippages Assessment of AES project implementation in Isabela

Risks	**Impact***(please rate from very low, low, high, very high)*	**Risk Management Strategies**	**Duration**
Low participation of farmers in the training	Very high	Intensive advocacy at the community level thru imposition of training importance	October – November 2013
Issues	**Priority***(please rate from low, medium, high, critical)*	**Actions Taken**	**Duration**
Misunderstanding among ARBOs in the cluster on the use of CSF	Critical	The project team provided feed back to DARPO-Isabela and asked for a mediation/negotiation process to take place, as this crucial in the project implementation	October 2013
Slippages	**Impact*(please rate from low-high)***	**Actions Taken**	**Duration**
Delayed activities	Low (since the delayed activities are still within the timeframe)	Implemented measures such as multi tasking of activities during coaching sessions to keep up with the project implementation.	October-December 2013

IV. SUMMARY, CONCLUSION AND RECOMMENDATION

A. Summary and Conclusion

The market-oriented agri-technology and agri-extension services project was conceptualized based on the recommendation of the third party SUC evaluator after NADA. It is a component of DAR-ARCESS particularly harnessing the participating ARBOs to become skilled and equip with knowledge on business align to the enterprise commodity that they have engaged in. Generally, this AES aims to provide trainings/technology transfer/coaching along the commodity/areas on value chain strategy for the ARCs in Isabela. Specifically, it aims to attain the following objectives: 1) strengthen farm efficiencies and productivity of rice and corn farmers thru provision of training in production technology and management, to wit: soil testing and fertility management, integrated pest management, organic fertilizer production, and farm management and planning; 2) enhance rice and corn farmers' knowledge on postharvest technology and management; 3) improve value-adding activities of rice and corn farmers thru implementation of training, fora, seminar on primary processing technology and management; 4) enrich rice and corn farmers' knowledge on CSF operations and maintenance; and 5) establish pool of technical experts thru training/coaching of farmer technicians thru Farmer Field School (Demo Farms).

There were five lead ARBOs who participated in this project classified into rice and corn based agri-enterprise communities located in 4 districts of Isabela. Various extension modalities were adopted to attain the set forth objectives of the project. Inception meeting was conducted to have levelling off from among ARBOs, Core Team and DAR about the project implementation.

The project activities were highlighted by two season long training programs one for rice and one for corn production. This was called FFS which is used as venue for lectures and demonstration of technologies on rice and corn. Various topics like farm planning and budgeting, seed selection, soil and nutrients management, integrated pest management, and postharvest processing were lectured goes along to the season long training program of both crops. Other entrepreneurial topics delivered

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werevermi culture for organic fertilizer, preparation of organic foliar fertilizer and bio-spray chemicals, mushroom production and smoked fish preparation. Parallel to this activity, sustainability planning, preparation of manuals, modules and IEC materials for both crops were also undertaken and validated by the members and officials of ARBOs.

The outcomes of the different extension modalities adopted were impressive since the project turn it out with the following: a) 39 farmers trained field technicians for corn and 93 farmers trained field technicians for rice; b) two field exposures (Lakbay-Aral) one for rice and one for corn to different private and public agencies outside the region; c) conducted seminar-workshop on sustainability planning; d) developed and disseminated training manuals, modules, technoguide and IEC materials for both crops; and e) various reports submitted to the DAR provincial and regional offices.

Farmers underwent to training program have attained greater knowledge, developed their skills on a specific technologies taught by the trainers and more confident in doing farming as business. Furthermore, relationships of farmer members in ARBOs have improved, becoming closer and open minded individuals regarding to the project.

There is high participation from among the stakeholders that lead to the successful implementation of this project in Isabela. On risk, issues and slippages confronted by the core team management of the project were resolved immediately at the first quarter through Catch-up project plan implementation.

B. Recommendation

Lead ARBOs participated to the project were much provided with technical and financial supports under DAR-ARCCESS-AES project that make them equip and knowledgeable on the commodity where they belong. The graduatelead ARBOsfarm-technician specialists must do their share to disseminate what they have learned to other farmers particularly to their constituent ARBOs service areas. The DARPO must provide assistancefor program development, financial need and other logistics for the conduct of field extension services of farm-technician specialist. The DAR must follow –up the trained lead ARBOs on the implementation of sustainability plan and conduct periodic evaluation for it.

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PICTORIALS

CORN SEASON LONG TRAINING PROGRAM

Mr. German Cabudol, Senior Agricultural Technician from LGU Jones serves as the Resource Speaker for the conduct of the Season Long Training on Corn Production at Bannawag, Jones, Isabela which commence on January 14, 2014.

Mixing of 2 bags 14 –14 –14 fertilizer with 5 bags Organic Fertilizer

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Mixing of corn seeds with BIO-N

Dr. Luzviminda Domingo and Dr. Diosdado Cañete applying fertilizer in the demo site on January 14, 2014

Conduct of 1st Agro Ecosystem Analysis (AESA) on January 22, 2014 at the demonstration site of the Season Long Training on Corn production in Bannawag, Jones, Isabela .

Presentation of AESA conducted on January 22 and 29, 2014

Presentation of AESA conducted on February 12, and 19, 2014

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Preparation of Organic pesticides like Fermented Fruit Juice, Fermented Plant Juice, Kuhol Amino Acids and Botanical Pesticides on March 5, 2014 as part of the Season Long Training on Corn Production.


Packing the collected plant/fruit juice for fermentation lead by Mr. German Cabudol of LGU Jones. .


Collecting/Harvesting of the fermented organic pesticides after two weeks by Mr. German Cabudol of LGU Jones. .

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Ms. Mindaflor Aquino of DA-RFO II discussing the topic on Integrated Pest Management on March 12, 2014.Participant inspecting the earwigs given by DA-RFO II. After the lecture Ms. Minda Flor Aquino distributed earwigs and trichograma to farmer-participants.

Dr. Alberto Domingo and Mr. Quinones pose at the demonstration site. The crop at 50 days after planting on March 5, 2014

The crop at 78 days after planting on April 2, 2014

RICE SEASON LONG TRAINING PROGRAM

Dr. Pedrita Medrano, Project Leader of DAR-ARCCESS AES delivers her Welcome Remarks and Rationale of the Training during the Opening Program on the Season Long Training on Rice Production. Ms. Jesbeth Quidasol , from DARPO delivers her Message during the Opening Program on the Season Long Training on Rice Production on December 4, 2013 at CVARRD Complex, ISU, Echague, Isabela.

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Dr. Evalyn Rose Romeroand Dr. Juanito Atiwag both Professor from the College of Agriculture while discussing the topic on Farm Planning and Budgeting on December 4, 2013 and Soil Analysis on December 17, 2013, respectively at CVARRD Complex, ISU, Echague, Isabela


Dr. Teodoro Agtunong and Prof. William Gabriel, both Professor from the College of Agriculture while discussing the topic on Seed Selection and Seed Bed Preparation on December 5, 2013 and Land Preparation on December 17, 2013, respectively at CVARRD Complex, ISU, Echague, Isabela.


Mr. Stanley Pastor, Technician from Agri-component Corporation discusses and demonstrated the proper use of the seed sowing machine distributed to ARBOs on December 19, 2013 at CVARRD Complex, ISU, Echague, Isabela.

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Technicians from Agri-Component Corporation while demonstrating the proper use of the rice transplanter at the demonstration area on December 19, 2013 at ISU, Echague, Isabela.


Dr. Pedrita Medrano and Ms. Jesbeth during the Ribbon Cutting Opening Program on the Season Long Training on Rice Production on December 4, 2013 at CVARRD Complex, ISU, Echague, Isabela.

Dr. Lucila Rocha, professor from the College of Agriculture while discussing the topic on Water Management on January 6, 2014 at CVARRD Complex, ISU, Echague, Isabela.

The ARBO-participants during an ocular visit at the Organic Farm of DA-ATI San Mateo on January 20, 2014 as part of the training on the Season Long Training on Rice Production.

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Ms. Jean Mirandilla from PHILRICE discusses on the topic Integrated Nutrient Management at the DA-ATI, San Mateo, Isabela on January 20, 2014

The participants while collecting soil sample for the preparation of the MOET as part of the lecture on Integrated Nutrient Management at the DA-ATI, San Mateo, Isabela on January 20, 2014

The participants while conducting the Minus One Element Technique (MOET) preparation as part of the lecture on Integrated Nutrient Management at the DA-ATI, San Mateo, Isabela on January 20, 2014

The participants while conducting soil analysis as part of the lecture on Integrated Nutrient Management at the DA-ATI, San Mateo, Isabela on January 20, 2014

The participants while collecting pests at the demonstration area of PHILRICE San Mateo as part of the lecture on Integrated Pest Management at the DA-ATI, San Mateo, Isabela on January 27, 2014

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The participants while collecting pests at the demonstration area of PHILRICE San Mateo as part of the lecture on Integrated Pest Management and The participants while identifying friendly and harmful insects found in the field as part of the lecture on Integrated Pest Management at the DA-ATI, San Mateo, Isabela on January 27, 2014

Ms. Grace Ama, OIC Director of PHILRICE San Mateo while discussing the topic on Integrated Pest Management at the DA-ATI, San Mateo, Isabela on January 27, 2014

Validation of CSF Business Plan at D4 Series CIA on January 21, 2014 at Minante I Cauayan City.

Finalization of CSF Business Plan at D4 Series CIA on January 28, 2014 at Minante I Cauayan City.

Participants pose in front of the Administration Building of the Philippine Council for Agriculture, Aquatic, Forestry and Natural Resources Research and

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Development (PCAARRD), Los Baños, Laguna during the conduct of Lakbay Aral on March 16-18, 2014

The participants and Spokesperson from PHILRICE pose in front of the administration building of PHILRICE Maligaya on March 18, 2014

The participants watch a video presentation of PHILRICE's programs and projects on March 18, 2014

Mr. Manuel Alejar, Associate Scientist of IRRI explaining the difference varieties of seeds developed by IRRI on March 17, 2014

Participant from D4 Series CIA while reading some information about rice at IRRI's Riceworld Museum and Learning Center on March 17, 2014

Participants from D4 Series CIA while examining one variety of rice at the demonstration area of PHILRICE, Muñoz, Nueva Ecija on March 18, 2014

Engr. Aldrin Hipolito explains to the group the different farm machineries and its uses at PHILMEC Nueva Ecija on March 18, 20114.

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Remote Monitoring and Control of Boat Using Lora Technology

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Abstract**—** *This work is a prototype boat that can travel in water. This robot is powered by rechargeable battery. The direction of the robot can be precise by an RF remote. This can be moved forward and reverse direction by using geared motors, also this robot can take sharp turnings towards left and right directions. In this work the LPC2148, DC Servomotors, RF Technology; L293D H-Bridge is used to drive the DC Servomotor. A high sensitive camera is also interfaced to capture the surrounding things and also to transmit to the remote place. The RF modules used here are STT-868 MHz Transmitter, STR-868 MHz Receiver. The three switches are connected to the RF transmitter through RF Encoder. The encoder constantly recites the position of the switches and permits the data to the RF transmitter and the transmitter transmits the data for further process.*

Keywords- RF Module, LPC2148, DC Servomotor, ATmega 16.

I. INTRODUCTION

In our daily life many people travel in boat. Sometime any atmospheric problem are occurred like landscape, tsunami etc. that time people can't be communicate for their safety purpose. This past of robotics is secured with the antiquities of technology, science and the basic principle of movement, electricity, even pneumatics and hydraulics would also be measured a part of the history of robotics [1].

The timeline presented is therefore far from complete. Robotics now signifies one of manhood's greatest activities and is the single greatest effort of mankind to produce an artificial, feeling being. It is only in recent years that constructors are building robotics progressively available and possible to the overall public. The attention of this timeline is to deliver the booklover with a general overview of robotics with a focus more on traveling robots and to give an gratitude for the inventors and innovators in this field who have helped robotics to become what it is today, the science and technology behind the design and manufacturing and application of robots [2]-[4].

The radio frequency (RF) and wireless have been around century of old development in the field of communication over a long range, for wireless radio growths in the early 20th century. In December 1901, Marconi done his most protruding experimentation, where he successfully transmitted Morse code from Cornwall, England, to St John's, Canada. The ability of a system to operate autonomously, carrying out tasks that are unachievable by conventional machines, opens up an enormous range of applications that are uniquely suited to automated processes requiring wireless communication over a range. Such systems need to operate over a wireless network in certain environments and achieve certain tasks [5]-[7].

The wireless automation is simply referred to radio frequency or GSM communication over the IoT (internet of things) platform. However, the choice of which communication platform (network based or radio frequency based) to be used is largely dependent on the nature of task to be carried out and what parameters are concerned with the process and particularly the cost effective nature of each platform to be used. Such parameters as mentioned above have very vital effects over the nature of design. For instance, a very important parameter is the range over which communication is to be established [8]. This determines largely what decisions are to be made as regards the operation of the system. This is because a lot of other parameters will vary as the range increases or decreases. These parameters are tied primarily to the communication and the range of communication such as cost, signal strength, receptivity and the number of processes to be controlled or operated. On the event of comparing varying effects of these mentioned parameters [9],

The RF communication is preferred for short range wireless communication. A maximum range of one hundred meters has been chosen as the required range over which communication is to be established and will determine the circumference of the work. In today's world as in, wireless communication over the embedded system platform has become a wide sphere of technological possibilities as very intelligent or complex

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processes requiring high precision in operation can be fully operated wirelessly, even from the comfort of one's home [10],[11].

The proposed work implemented in wireless controlled robotic boat to travel in water. This work is done by using RF technology for audio transmission as well as reception. The boat is powered by 9V rechargeable battery. The path of the boat will be precise by an RF remote. This can be moved forward and reverse direction. Also this robot will take severe turnings to left and right directions. There are various type of recent technology are being implemented such as experiments in robotic boat localization in Oct. 2007 [12],

The RF based wireless boat control. This boat circuit uses the RF module (Tx/Rx) for building a wireless remote, which would be used to enterprise an output from a long distant place. RF module, as the name advises, uses radio frequency to send signals. These signals are communicated at a particular frequency and a baud rate. A receiver can receive these signals only if it is shaped for that frequency. A four channel encoder/decoder couple have also been used in this system. The input signals, at the transmitter side, which are taken by four switches while the outputs are supervised on a set of four LEDs consistent to each input switch. The circuit can be used for scheming remote application control system. The outputs from the receiver can drive corresponding relays connected to any household appliance [13]-[15].

The RF is a frequency or degree of oscillation within the sort of about 3 Hz to 300 GHz This range matches to frequency of irregular current electrical signals used to harvest and perceive radio waves. The electrical currents that vacillate at RF have unusual assets not communal by direct current signals. One such stuff is the ease with where it will ionize air to produce a conductive path through air. This property is broken by 'high frequency' units used in electric arc welding. Another special property is an electromagnetic force The RF current to the surface of conductors is also driven by electromagnetic force, known as the skin effect [16],[17].

II. BLOCK DIAGRAM

Initially considering the entire system come across two different section, namely, transmitter section and receiver section. The robot is a programmable mechanical device that will accomplish tasks and cooperate with its atmosphere, In transmitter part a data encoder and RF transmitter is used. In transmitter section consist four push buttons to trip the robot; this four buttons are associated with encoder with respect to ground. When will press any button encoder, will have a digital squat signal and then applied this signal successively to RF transmitter [18]. The figure 1 shows generalized diagram of robotic boat system.

Fig.1: Generalized Diagram of Robotic Boat System.

The encoder IC HT12E encodes data or signal or converting into serial form and then sends this signal by using RF transmitter into the environment. At the receiver end used RF receiver to receive data or signal and then applied HT12D decoder [19]. This decoder IC converts all the received serial data parallel and then send these decoded signals to motor drive IC. According to received data robots runs by using two DC motor in forward, reverse, left, right and stop direction. The figure 2 shows block diagram of robotic boat system.

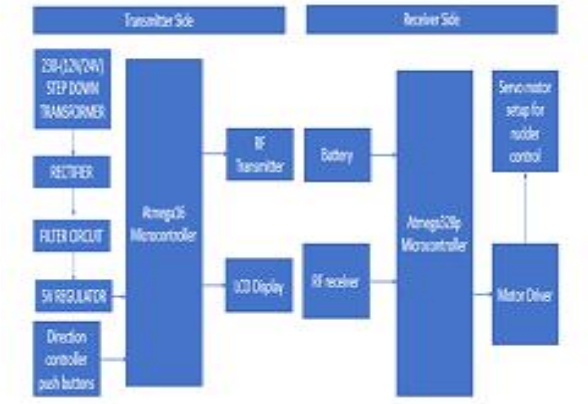

Fig.2: Block Diagram of Robotic Boat System

III. TRANSMITTER and RECEIVER

Transmitter section: The RF transmitter STT-468 is ideal for remote control applications where low cost and longer range is required. The transmitter operates from a 5-12V supply, it marks ideal for many battery-powered applications. The transmitter services a SAW-stabilized oscillator, certifying precise frequency control for best range routine. The manufacturing-friendly SIP style package and low-cost make the STT-468 suitable for high volume applications [20]. The digital data is collected from the CMOS. This input is CMOS compatible and should be driven with CMOS level inputs the VCC is the Operating voltage for the transmitter. The VCC should be avoided with a .02uF ceramic capacitor and filtered with a

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4.7uF tantalum capacitor. Noise on the power supply will damage transmitter blare performance. The ANT is 50 ohm antenna output. Their antenna port side impedance touches output power and harmonic emissions. Antenna can be single core wire of approximately 17cm length or PCB dash antenna.

B. Receiver section- Here all the data is received by the RF receiver from the antenna pin and this data is offered on the data pins. The two Data pins are provided in the receiver module. Thus this data can be used for further applications [21]. The figure 3 (a) and (b) shows pin diagram of RF transmitter and receiver STR-433Mhz.

Fig.3 (a) Pin Diagram of RF Transmitter STR

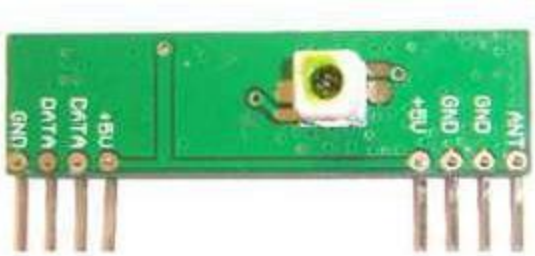

Fig.3 (b) Pin Diagram of RF Receiver STR

The RF transmitter and receiver have the advantages such as: TR Not blocked by common materials: It can penetrate most solids and pass through walls. Longer range It is not sensitive to the light and It is not much sensitive to the environmental changes and weather conditions [22].

IV. SERVO MOTOR AND CONTROLLER

Fig.4 Servo Motor and Controller

The servo motor is an electrical device which can push or rotate an object with great precision. This motor is to revolve and object at some specific angles or distance, then use servo motor. This is just made up of simple motor which run through servo mechanism [23]. The motor which used DC supply for their operation is called DC servo motor, and if it operates by AC power supply then it is called AC servo motor. These motors have very high torque in a small and light weight packages. Because of these features they are being used in many uses like toy car, RC helicopters and planes, Robotics, Machine etc. The figure 4 shows servo motor with its controller [24].

The servo motors are rated in kg/cm (kilogram per centimeter) mostly servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells how much weight the servo motor can lift at a particular distance. For design: A 12kg/cm servo motor should be able to lift 12kg if the load is suspended 2cm away from the motors shaft, while superior the distance then lesser the weight carrying ability. The position of a servo motor is decided by electrical signal and its circuitry is positioned near the motor [25].

It is a closed loop system where it uses feedback system to control indication and final position of the shaft, the device is precise by a feedback signal generated by matching output signal and reference input signal. There reference input signal is compared to reference output signal and the third signal is creates by feedback system. And the third signal work as input signal to control device [26]. This signal is extant as long as feedback signal is generated and there is difference between reference input signal and reference output signal. So the key duty of servomechanism is to maintain output of a system at wanted value at presence of noises [27].

The servo contains of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit. Primarily we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor shaft, their location of the potentiometer handle is ready in such a way that there is no electrical signal produced at the output port of the potentiometer. After words an electrical supply is given to alternative input station of the error detector amplifier. And then difference between these two signals, one comes from potentiometer and alternative comes from other source, will be handled in feedback mechanism and output will be delivered in term of error signal. This error signal acts as the input for motor and motor starts rotating [28].

Now motor shaft is connected with potentiometer and as motor revolves so the potentiometer and it generates a signal. So as the potentiometer's angular position changes and its output feedback signal changes. After some time instant the location of potentiometer extents at a location that the output of potentiometer is same as external signal provided. At this condition, there will not be output signal from the amplifier to the motor input as there is no

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difference between external realistic signal and that signal produced at potentiometer, and in this condition motor stop rotating [29]. The figure 5 shows potentiometer for servo motor control.

Fig.5 Potentiometer for Servo Motor Control

The all motors have three wires coming out of them. Out of all two will be used for Supply (positive and negative) and one can be used for the signal that is to be sent from the MCU. The servo motor is controlled by PWM (Pulse with Modulation) which will be delivered by the control wires. There will be a least pulse, a full pulse and a repetition rate. The servo motor can turn 90 degree from either direction form its neutral position. The servo motor supposes to see a pulse every 30 milliseconds (ms) and the length of the pulsation will control how far the motor turns. For a case, a 1.8 ms pulsation will make the motor turn to the 90° position, such as if pulse is shorter than 1.8 ms shaft moves to 0° and if it is longer than 1.8 ms than it will turn the servo to 180° [30].

V. POWER SUPPLY and MICROCONTROLLER

The power supply circuit contains a step-down transformer which is 230/12v. In this circuit 4diodes are used to route bridge rectifier that supplies pulsating dc voltage and then fed to capacitor mesh and the output voltage which comes from rectifier is fed to filter to disregard any a.c. components present even after rectification. The strained DC voltage is supply to controller to produce 10 to 12v constant DC voltage. 230V AC power will be adapted into 12V AC (12V RMS value wherein the peak value is around 17V), whereas the mandatory power is 5V DC; for this purpose, 17V AC power must be mostly converted into DC power then it will stepped down to the 5V DC. AC power can be transformed into DC by rectifier. Here different types of rectifiers is used, such as half-wave rectifier, full-wave rectifier and bridge rectifier. Due to the benefits of the bridge rectifier over the half and full wave rectifier, the bridge rectifier is commonly used for transforming AC to DC. The figure 6 shows the circuit of a power supply which transforms an ac source to a dc source [31].

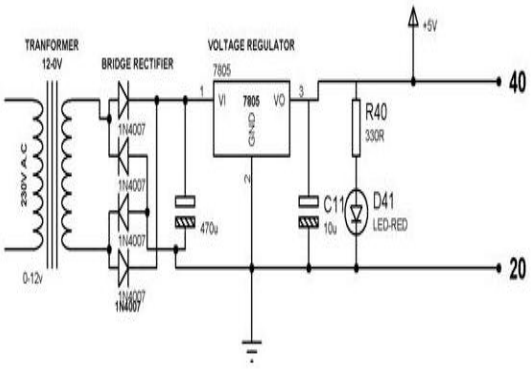

Fig.6 Power Supply Circuit

The AVR is a family of microcontrollers developed by Atmel beginning in 1996. These are called modified Harvard architecture 8bit RISC single-chip microcontrollers as opposed to one-time programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time. The AVR architecture was perceived by two students at the Norwegian Institute of Technology (NTH).

The original AVR MCU was developed at a local ASIC house in Trondheim, Norway, called Nordic VLSI at the time, now Nordic Semiconductor, where Bogen and Wollan were working as students. It was a µRISC (Micro RISC) and was accessible as silicon IP/building block from Nordic VLSI. When that technology is vended to Atmel from Nordic VLSI, the internal building was further developed by Bogen and Wollan at Atmel Norway, a secondary of Atmel. The engineers functioned closely with compiler at IAR Systems to guarantee that the AVR instruction set provided effective compilation of high-level languages [32]

Atmel says that the name AVR is not an abbreviation and does not stand for whatever in actual. The inventers of the AVR give no conclusive solution as to what the term "AVR" stands for conversely, it is commonly accepted that AVR stands for **V**egard's **R**ISC processor, the use of "AVR" in this article usually refers to the 8-bit RISC line of Atmel AVR Microcontrollers. Among the first of the AVR line is AT90S8515, which has 40-pin DIP package structure in the same pin out as 8051 microcontroller, which includes the external multiplexed address and data bus.

The following are the features of the microcontroller such as: Multifunction, bi-directional general-purpose I/O ports with configurable, built-in pull-up resistors. Multiple internal oscillators, including RC oscillator deprived of external parts. Interior self-programmable instruction and flash memory capacity is up to 256 KB (384 KB on XMega). In-system programmable using serial/parallel

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low-voltage exclusive interfaces or JTAG. Optional boot code section with autonomous lock bits for protection. On-chip repairing (OCD) provision through JTAG or debug WIRE on most devices. The JTAG signals (TMS and TCK) are multiplexed on GPIOs. This pins is arranged to purpose as JTAG or GPIO depending on the venue of a fuse bit, which can be programmed via ISP or HVSP. By default, AVR and JTAG come with the JTAG interface enabled. Debug WIRE uses the /RESET pin as a bi-directional communication channel to contact on-chip debug circuitry. It is present on devices with lower pin counts, as it only requires one pin [33].Internal data EEPROM up to 4 KB. Internal SRAM, 16 KB (32 KB on X Mega). External 64 KB little Indian data space on positive models, including the Mega8516 and Mega162. The figure 7 shows the AT mega162 microcontroller pin diagram

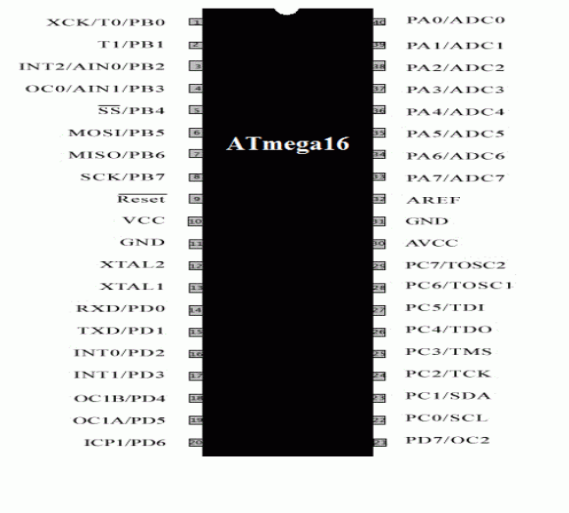

Fig.7 AT mega162 Microcontroller Pin Diagram

The Liquid crystals are a phase of matter whose order is in-between that of a liquid and that of a crystal. The particles are naturally rod shaped living matters it is nearly 25 Angstroms in length and this ordering is a task of temperature. Applied electric fields can be controlled by molecular orientation. LCD is made by two sheets of polarizing material with the liquid crystal solution between it. An electric current supplied over the liquid heritages the crystals to bring into line so that light cannot pass through them, Results on display of character as per the realistic voltage in its data lines. The carter is provided to drive the LCD. It supplies the data of display which transferred from the microcontroller in the internal display RAM and generates dot matrix liquid crystal driving signals. Each bit data of display RAM links to on/off state of a liquid crystal display. LCD is used in widespread applications due to the following reasons: The declining prices of LCDs, ability to display numbers, characters, and graphics, incorporation of a stimulating regulator into the LCD, thus, releasing the CPU of the duty of revitalizing the LCD, and ease of programming for characters and graphics [34]. The figure 8 shows the image of a 16x2 LCD display.

Fig.8- 16x2 LCD display

VI. CONCLUSION

There are number of wireless technologies are available having different features, applications and limitations. From above analysis it will be very useful for wireless communication, these sources are easily available now days, and hence the proposed system becomes more cost effective and economical. The proposed system will use oceanic research centers application for interfacing RF module and controller.

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Study of some Mechanical Properties of Galvanized 4140 Steels

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Abstract— *The effect of three different galvanizing processes on the microstructure and tensile behavior and hardness of galvanized AISI 4140 steels was investigated. The thicknesses of the galvanized layers were measured as 34 μm, 90 μm and 140 μm for the electro galvanized, zinc-rich coated and hot dip galvanized AISI 4140 steels, respectively. No significant increase in tensile strength was observed with the galvanizing process. It was even observed that there was a decrease in tensile strength compared to the samples that were not galvanized. It is concluded that galvanizing processes is not effective in improving the tensile performance of AISI 4140 steels.*

Keywords— galvanizing, steels, microhardness, tensile behaviour.

I. INTRODUCTION

Steels have always been among the most favored and widely used materials because of their strength, formability, and the economics of production. However, Alcantara et al. (2017) reported that the atmospheric corrosion of carbon steels is an extensive topic that has been studied over the years by many researchers. Baboian (1995) and Pistofidis et al. (2006) proposed that the most popular and most widely process used for the protection of steel against corrosion is galvanizing.

The most commonly used methods for galvanization is hot dip galvanizing and electro galvanizing. On the other hand, zinc-rich paints (ZRPs) coatings are also one of the most effective coatings used in order to protect steel from corrosion. Marchebois et al. (2004) indicated that ZRPs are used in many aggressive media: sea water, marine and industrial environments. Corresponding to this, Bin Sofian (2014) showed that ZRPs are one of the most effective anticorrosion coatings for plain carbon steels, acting simultaneously as a very adherent barrier layer and providing galvanic protection. In addition, Feng et al. (2016) obtained that the ZRPs present on electro-galvanized steel is finer, denser, thinner, more uniform and has better corrosion resistance than the hot-dip zinc coating. Di Giovanni et al. (2017) reported that the hot dip galvanizing bath not only activated temper embrittlement, but also caused the thermal stresses in the structure which were the driving force for the cracking in welded steel platform structures.

Over the past few decades, many articles have already been published on some mechanical properties in addition to corrosion behavior of galvanized steels. To summarize, Sirin obtained that the fatigue strength of AISI 4340 steel decreases from 327 MPa to 207 MPa after hot dip galvanizing with a 36,7% decrement. Khosravi et al. (2013) showed that with the increase in welding current, grain size increases and results into the increase of brittle fracture in electrogalvanized steel sheets. Lazik et al.(1995) indicated that cracking in zinc coatings depends not only on the overall texture with respect to macroscopic stress or strain state, but also on the local grain misorientation, and the inherent grain boundary strength. Especially in the hot dip zinc coatings. The intensity of cracking increases with an increasing thickness of the intermetallic layer. Safaeirad et al., (2008) reported compared to uncoated steel, low-carbon steel sheets coated by hot dipping have slightly less ductility because of the thermal effects of the coating process. However, there is no paper deal with the direct study of mechanical properties such as tensile properties and hardness behavior of galvanized 4140 steels. The purpose of this study is to investigate and compare the structure and properties of galvanized and ZRP-coated AISI 4140 steels.

II. EXPERIMENTAL METHOD

AISI 4140 steel plates (diameter: 12.9 mm) were industrially electrogalvanized using a cyanide-free alkaline bath containing Zn^{2+} (12.5 g/L), KOH (170 g/L), K_2CO_3 (50 g/L), additive (10 ml/l), brightening agents (1 ml/l), and conditioner (10 ml/l). The following conditions were used: room temperature and cathodic current density of 3 A/dm^2 for 40 min. A second group of AISI 4140 plates was hot dip galvanized into a zinc bath at a temperature about 560 ^{0}C for 3 min. A third group of AISI 4140 plates was coated with ZRP. Tensile tests were conducted at room temperature using an electro-servo

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hydraulic testing machine with 250 kN capacity. Tensile load and strain were monitored during the tensile tests using a commercial load cell and strain gauge, respectively, where tensile loading was conducted at a crosshead speed of 0.1 mm/min to fracture. To determine the hardness of the samples, a Vickers micro hardness tester with a load of 100 g and dwell time 10 s was used. Many indentations were made on each coating film under each experimental condition to check the reproducibility of hardness data. Microstructural characteristics were investigated for each of the different coatings using an optical microscope.

III. RESULTS AND DISCUSSION

Cross section morphologies of the hot dip galvanized, electro-galvanized and ZRP-coated AISI 4140 steels examined by optical microscopy are given in Fig 1 a-c.

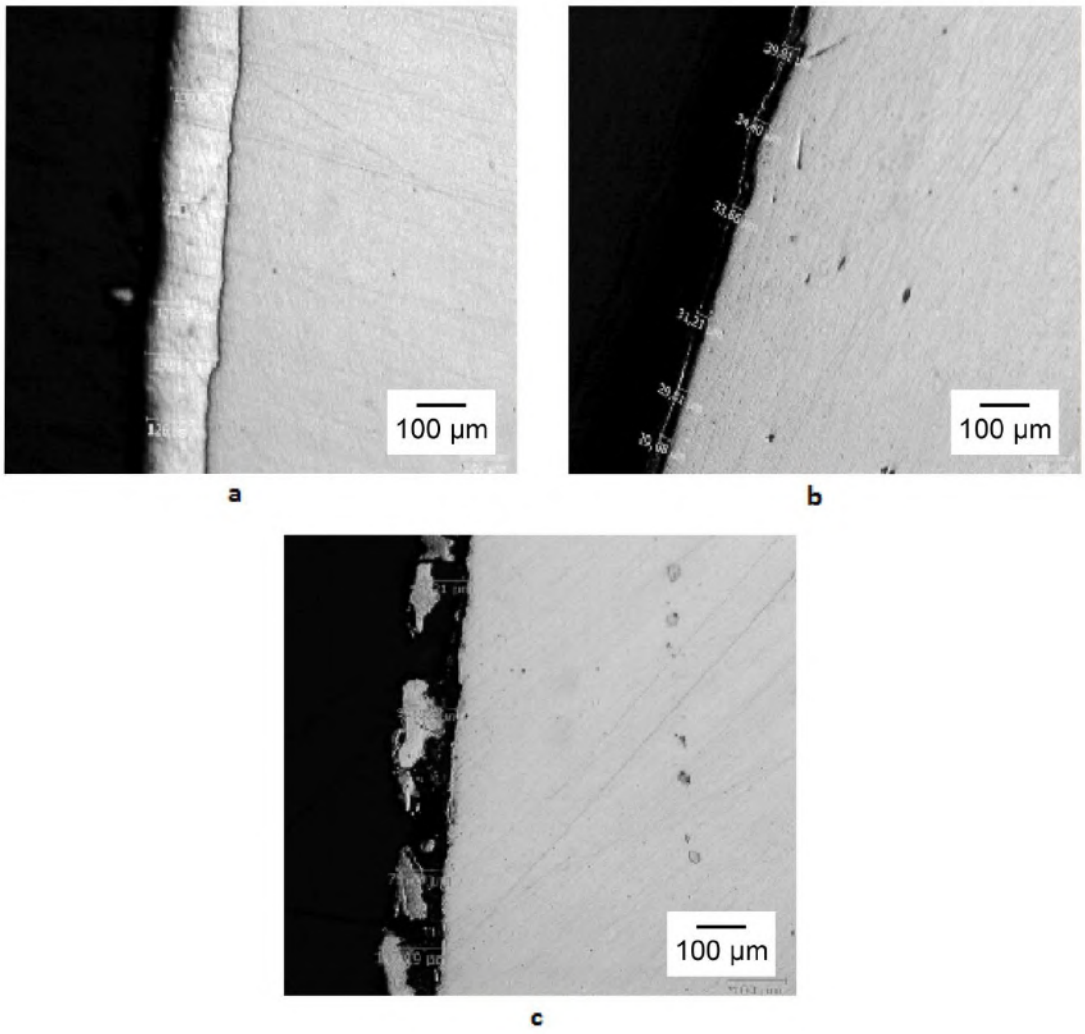

Fig. 1. Cross sections of galvanized layers of the (a) hot-dip galvanized, (b) electrogalvanized and (c) ZRP coated AISI 4140 steels.

As shown in the figure, the coating on the hot-dip galvanized AISI 4140 steel has greatest thickness among the three coatings. The thicknesses of the coating thicknesses are compared, the thickness of the coating in the electrogalvanized AISI 4140 steels is 34 µm, whereas the thicknesses are 90 µm and 140 µm for ZRP-coated and hot dip galvanized AISI 4140 steels, respectively. The boundary between the coating and substrate is clear. We say that holding on the surface of the material is weak and unstable due to the weakness between the activation energy and the diffusion energy in the material surface for this galvanizing process. On the contrary, the surface adhesion is more stable in electro-galvanized and ZRP-coated AISI 4140 steels. There is no a transition region in these galvanized steels. The unstable different phase structures were obtained in the coating layer of ZRP-coated AISI 4140 steels. In addition, the dark regions were obtained especially in the coating layers of electro-galvanized and ZRP-coated AISI 4140 steels due to etching effect (Fig. 1 b and c).

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Table 1. Tensile and microhardness values for the galvanized and ZRP-coated AISI 4140 steels

Galvanizing processes	σ_{UTS} (MPa)	σ_{YS} (MPa)	Elongation ϵ (%)	Hardness (HV)
Untreated	1188	1099	15.0	360
Electrogalvanized	1195	1093	17.2	357
ZRP	1169	1079	16.4	365
Hot-dip galvanized	1117	1032	15.9	352

Table 1 shows the tensile properties (ultimate tensile strength σ_{UTS}, yield strength σ_{YS}, and percent elongation ϵ (%)) and micro hardness values of the steels coated with the three different processes. As seen from the table, the σ_{UTS} and σ_{YS} values for the galvanized and ZRP-coated AISI 4140 steels are more or less the same as that of the untreated steel. The slight decrease observed in the hot-dip galvanized steel can be attributed to the annealing effect of the Zn bath. Similar behavior is observed in the hardness values from the indentations, where the hot-dip galvanized steel is softest. The percent elongation values are again very similar; however the slightly higher ductility of the electrogalvanized sample can be attributed to the presence of a smooth continuous coating on the surface.

IV. CONCLUSIONS

Three coating methods were applied to the AISI 4140 steels. The changes observed in ultimate tensile strength, yield strength and hardness were negligible. A slight increase in elongation values were observed compared to untreated AISI 4140 steel. The results showed that while galvanized and ZRP coatings can be used to protect the surfaces of steel against corrosion, they cannot be used to improve mechanical properties.

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Validation of Hydraulic brakes for Electric Vehicles

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Abstract**—** *This document shows the validation of the hydraulic brakes occupied in a solar electric vehicle. The braking system evaluated consists of two components: the brake pedal with master cylinder and the wheel brake mechanism, together with the corresponding tubes or conduits and the clamping pieces.*

This validation is carried out through the analysis of forces, in the first part the braking force between the tire and the floor is determined; subsequently the force is calculated in the main braking system which is activated by a pedal

The braking system with which it is suitable for the prototype in question is that of a Volkswagen sedan, because this brake system meets the needs of drivers in terms of efficiency.

Keywords— Prototype, validation, brake system.

I. INTRODUCTION

The braking system is an indispensable device for the safety of the driver, for years it has evolved implementing different methods to improve its performance, however the method of hydraulic braking has been one of the most effective and efficient, has had some modifications in its form of application, but in general it has continued to operate by the pascal principle which says that the pressure exerted in a closed system is the same in all directions and directions.

Objective

Design brakes for an electric vehicle for urban use.

Methodology

For the analysis of the braking system, the braking system of a Volkswagen sedan will be considered since it is an efficient braking system and matches the characteristics of the vehicle being made.

The calculations are based on the braking system of Figure 1, since this system has been performed in other vehicles and has delivered good results in its operation.

The current situation of the company was investigated through surveys carried out with engineers and workers from different areas, and the results obtained by the company's laboratory were analyzed.

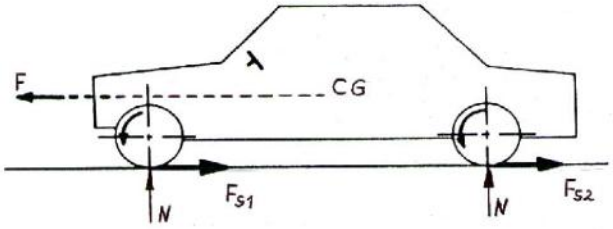

Fig.1: Friction forces retaining the movement of the car.

It is estimated a maximum speed of the prototype is 75 km / h, whose mass is 980 Kg.

Braking forces between the tire and the floor.

When the surfaces in contact between two bodies are perfectly smooth, the forces of interaction of the bodies always act in a direction normal to the surface at the points of contact. However, all surfaces are actually rough and it depends on the nature of the problem to be considered and on the ability of a body to withstand tangential and normal forces on its contact surfaces. The tangential force is caused by friction.

In cars, a force Fs of resistance acting on the tires acts which prevents or retards its sliding in relation to the surface or ground with which you are in contact between the tire-floor and is directed in such a way that it opposes the Possible or existing movement of the wheel in relation to these points.

In the friction of the wheel, the resistance is caused by the interference of small deformations or grooves formed when rolling one surface over another.

We must take into account that the forces of friction produced by the wheel's adhesion to the ground allow the tires to roll or the car to move on the ground, since the force F applied to the center of gravity of the vehicle that circulates on the ground has to be greater than the friction force in friction between tire-plane, that is, that F> Fs the car moves, otherwise if the force Fs> F the car is not move to.

In the case of braking, that is to say when the brakes are applied through the actuating pedal exerted by the driver, the vehicle is retained by the friction forces Fs1 and Fs2

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between the pneumatic floor since the force F is less than the friction force between the wheel and the floor.

The force of friction is directly proportional to the force that the wheel is subjected to on the floor and can be calculated:

$Fs = N * \mu S$ (1)

Data:

μS = is the friction between the two surfaces in pneumatic-ground contact is measured by the static friction coefficient μS, which is the coefficient between the friction force and the N of the force that the tire is subjected to on the ground.

Table 1 shows the values of the adhesion coefficient μs.

Table.1: Adhesion coefficient values

Type of ground	Condition	New tire	Used tire
Concrete	Dry	1	1
	Wet	0.7	0.5
Thick asphalt	Dry	1	1
	Wet	0.7	0.5
Normal asphalt	Dry	0.6	0.6
	Wet	0.5	0.3
	Mud	0.2	0.1
	Ice	0.05	<0.05
Compact asphalt	Dry	0.6	0.6
	Wet	0.65	0.3

Due to the mass of the vehicle, the force applied to each tire is 2403.45 N.

According to table 1 the friction force is:

Dry Normal Asphalt: 0.6

Fs = (2403.45 N) (0.6) = 1442.07

Wet Normal Asphalt: 0.5

Fs = (2403.45 N) (0.5) = 1201.725

Braking force in the main brake systems.

The main brake system is activated by a pedal located inside the vehicle, by the driver. The effort exerted on the pedal is transmitted to the braking elements Zapata, tabor or disc through a hydraulic circuit, in which a master cylinder or brake pump is available where the pressure in the liquid is generated, which is transmitted by the pipes to the wheel cylinders that drive the shoes or pads.

Braking force in the control of the main hydraulic brake circuit.

The pressure that is to be applied to the brake pads or pads is achieved, first, by the mechanical effort by the pedal lever and under the pressure of the driver's foot.

The brake pedal consists of the lever that applies the pressure of the foot, turns on its axis transmitting the effort to the pump, in the direction of F1, the spring 2 allows the pedal to return to its initial position when the driver stops 'Press the brake pedal.

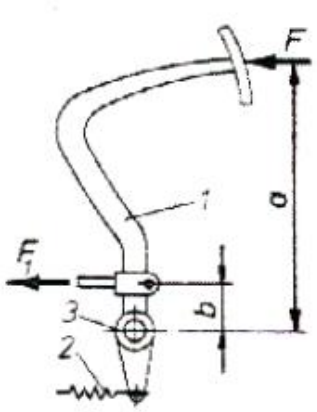

Fig.2: Forces on the brake pedal.

In Figure 2, the force F1 exerted on the piston rod of the brake pump is calculated from the effort F performed by the driver on the pedal, the latter force was measured based on tests with the dynamometer applied to a Volkswagen sedan car whose result when applying the force on the pedal to achieve compression was: 107.91 N, similarly the data based on the distances were obtained from the same type of vehicle.

Data obtained:

a = 20 cm = 0.06 m

b = 0.6 cm = 0.27 m

F = 107.

$F1 = (F * a) / b$ (2)

To solve the unknown, we substitute the data in equation 2 and we have:

F1 = ((107 N) * (0.2m)) / 0.06m = 356,666 N

As the F1 force in the hydraulic circuit it is important to determine the pressure PB exists in the brake pump which is equal to:

DATA:

F1 = 356,666 N

(Ø1) 2 = Diameter of the master cylinder is: 2.21996 cm = 0.0221996 m

p_ (B = F1 / (Ø _ (/ 4) ^ (2 * π))) pB = 356.66 / 0.0221996 * 3.14 / 4 = 50,473,119 N / m2

With Ø1 the diameter of the plunger of the brake pump of figure 3.

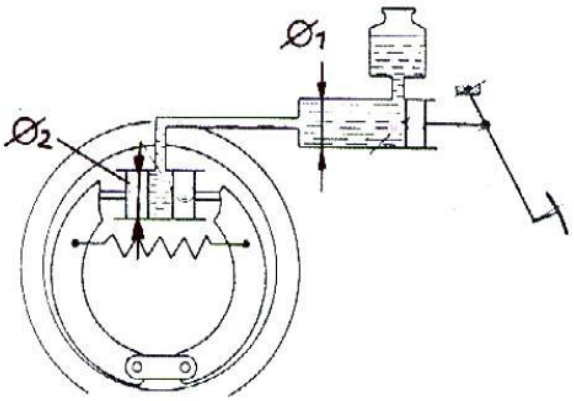

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Fig.3: Diameter of the pump and cylinder.

The pressure in the bowls (Pb) is shown in Figure 4, and is calculated as follows:

Pb = x = F_2 / ((Ø_2 ^ 2 * π) / 4) (3)

Since Ø_ (2,) the diameter squared of the wheel plunger pushes the shoes against the drum or pads against the disk to cause the wheels to lock.

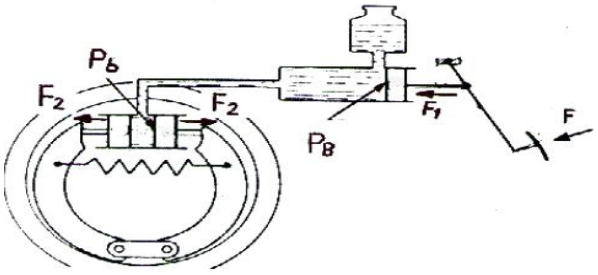

Fig.4: Hydraulic brake circuit.

The F1 force communicated to the rod of the cylinder is amplified by the hydraulic system which is based on the fact that the liquids are not compressed and that according to the law of pascal "The pressure exerted on any point of a liquid mass is transmitted in all directions and directions "The pressure pB obtained in the main brake pump is equal to the pressure in the wheel bowls and therefore F2 can be calculated:

F2 = (F_1 ^ * Ø_2 ^ 2) / (Ø_1 ^ 2) (4)

Substituting values in equation 4 we have that the pressure PB or force two is equal to 261.63 N.

F2 = ((356.66) * (0.01905) 2) / ((0.0221996) 2) = 262.6358 N

Where the force with which the pistons of the wheel pushes the shoes against the drum F2, is equal to the product of the force F1, obtained in the push rod of the plunger of the brake pump by the diameter Ø_2 of the piston of Wheel cylinder squared on the diameter Ø_1 of the squirt of the pump squared.

So the force F2 depends a lot on the reaction in the selections of the pistons in the cylinders of the pump and the bowler

Braking time

Considering the maximum speed of the car is 75 km/h, with new tires on the normal dry asphalt whose coefficient of adhesion is 0.6, the time taken to stop the car from the moment the driver observes an obstacle to apply the brakes until the vehicle comes to a complete stop;

Tp = v / μ * g +1 (5)

Tp = (75 * 0.27 m / s) / (0.6 * 9.83 m / s ^ 2) +1

Substituting values in equation 5, the braking time of the vehicle will be 4.2 seconds.

Calculation of friction forces between braking elements and the friction force between tire-floor.

To know the frictional force between the braking elements (brake pedal and force), it is considered that the driver exerts a pressure of 11 kilograms force therefore the force will be 107.91 N. The friction between the wheel and the floor is due calculate to know the force necessary to stop the vehicle considering that the maximum speed of the car is 75 km/h.

To calculate the force F1 you get the result of the brake pedal levers on the push rod of the brake pump.

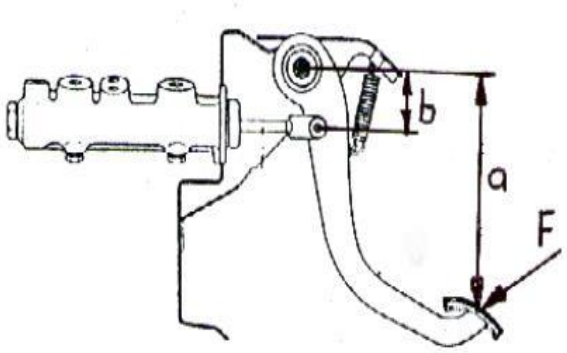

Fig.5: Brake pump

The data to determine F1 are shown in Figure 5.

Data:

a = 20 cm

b = 6 cm

F = 107.91 N

F1 = F * a / b

F1 = (107.91 Nm) / (20cm * 6cm) = 359.7 N (6)

Substituting values in equation 6, the force of the rod is 259.7 N and the latter increased with respect to the force applied by the conductor.

The next step is to calculate F2, which is obtained in the wheel of the later cylinders that are drum type.

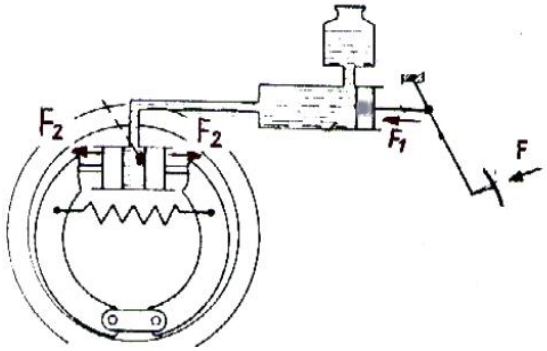

Fig.6: Brakes

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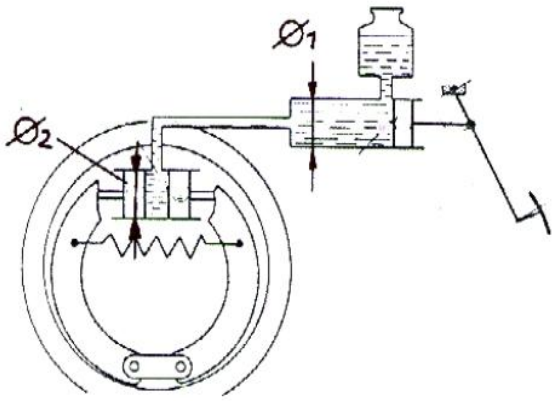


Fig.7: Diameter of the cylinders

In figures 6 and 7, F, F1, F2 are schematized in the brake circuit.

Now we calculate the force that is obtained in the rear wheel cylinders (F2).

Ø1 = 2.21996 cm

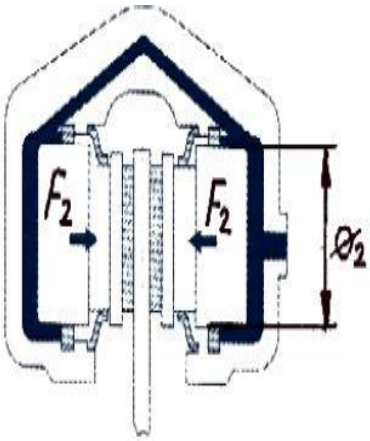
Ø2 = 1.9050 cm

F2 = F1 * Ø22 / Ø12 (7)

F2 = 359.7 N * (19.05 mm) 2 / (22,199) 2

F2 = 264.41 N

We also calculate the force F2 that is obtained from the cylinders of the disc-type front wheels:



Forces of the disc-type brake pistons

Ø1 = 20 mm

Ø2 = 52.30 mm

F2 = F1 * Ø22 / Ø12 (7)

F2 = (359.7 N) (52.30 mm) 2 / (20 mm) 2

F2 = 2459.70 N

We will proceed to calculate the friction between the wheels Ft for the rear wheels:

Ft back = F2 back * μ (8)

Ft back = 264 N * 0.3 = 79.2

We multiply for each back wheel and this would be equal to: 158.4 N.

Then the force of the front tires is calculated with equation 8.

Ft forward = 2479.70 * 0.3 = 743.91

We multiply by the number of front wheels and this is equal to: 1487.82 N

For the calculation of the total Fs, the frictional forces of the rear and front wheels Ft = Fs * d'/ d are taken into account

Ft = (Front Ft + Ft back) * d / d (9)

Ft = (158.4 + 1487.82) 11.3 / 27

Ft = 688.97 N

The total friction force (Fs) is 688.97 N, and is equivalent to 107.91 N, which is the minimum force that the driver must apply when operating the brake pedal.

II. RESULTS

The braking system with which a Volkswagen sedan is one of the strongest alternatives for the implementation of the prototype, because this brake system meets the needs of drivers in terms of efficiency.

III. CONCLUSIONS

The results show that the brakes chosen for the prototype have the ability to stop the vehicle whose maximum speed will be 75 km / hr.

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