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An In-Depth Exploration of Agricultural Efficiency within the Context of Mizoram: An Analysis of Current Practices, Challenges and Opportunities.

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Abstract

Food is the basic need for human life and agriculture is an activity that allows meeting that demand. Man has been improving his agrarian activity by adding domestication of animals and to supplement his food supply by the flesh of animals and plants that he raises. Agriculture revolution some 10,000 years ago is still believed to be of utmost significance to mankind as it led to a new era in the use of energy. Adoption of agriculture resulted in reducing the amount of energy man had to spend in obtaining a unit of food. He began to develop better efficiency in tapping the solar energy cycle than the hunting and gathering (Cook, 1975). Hubert (1969) equates evolution of human culture with his increasing ability to control and manipulate energy of which agriculture has been the most significant development. Growth of agriculture also led to an era of higher rate of growth and increase in population density. And though it is doubtful to establish the geographical conditions in which Agriculture Revolution found its root (Saur, 1952) there is no denying the fact that it provided mankind a more sedate way of living that later flourished in the river valleys. Most of the ancient civilizations stand testimony to it and where agricultural operation could be carried out more conveniently. However, irrational and excessive use of environmental resources attributed mainly to increasing growth of population is believed to have led to the decline in the carrying capacity and demise of many old civilizations. People sought areas where there would be better productivity and better opportunities for resource use hence food security. Expansion of agricultural activities and ancient migration of people may largely be attributed to this fact.

Keywords: Agriculture, Agrarian, Activity, Domestication, Supplement, Mankind, Revolution, Efficiency, Energy, Growth, Density, Civilization, Environment. Resources, Productivity, Population.

Introduction

The challenges of food supply exacerbated by the Industrial Revolution, which led to significant population growth and diverse land use. It highlights a global debate between meeting the increasing demand for agricultural output—expected to more than double by 2050—and the environmental impact of current farming practices, which are major contributors to greenhouse gas emissions and ecological damage. The source emphasizes that despite increased production, food scarcity persists in many regions due to inefficiencies, waste, and diversion of crops for animal feed and biofuels. The text also examines India's agricultural landscape, noting its continued economic significance despite a declining share in GDP and challenges like land degradation and shrinking landholdings. Finally, the document introduces a specific study focusing on agricultural efficiency in Mizoram, an Indian state grappling with hilly terrain, traditional farming methods, and food insecurity, aiming to understand factors influencing its agricultural productivity.
The state of Mizoram is geographically located between 21° 58' N - 24° 35' N latitudes and 92° 15' E - 93°29'E Longitudes. ** The state is bounded by Bangladesh in the West and Myanmar in the East and South. It shares a common boundary with Cachar District of Assam and the state of Manipur in the north and with the state of Tripura in North-West. It has about 722 Km International Boundary together with Myanmar and Bangladesh (404 km. with Myanmar and 318 Km. with Bangladesh).

***Dr Rintluanga Pachuau,Lecturer in Geography, Pachhunga University College, Aizawl ; Asserts that the location of Mizoram is 21° 56' N - 24° 31' N latitudes and 92° 16' E - 93°26' E longitudes; Khawiah nge Mizoram in Dah !, Mizoram Science Journal (1993) (In mizo language) : August, pp. 11 – 15 : Also see Geography of Mizoram (1994): Dr. Rintluanga Pachuau, R.T. Enterprise, Aizawl.*

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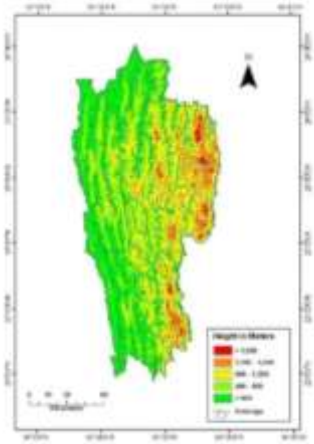

Its maximum dimensions are 277 Km from North to south and 121 Km from East to west. The location of Mizoram is unique in the sense that similar ethnic groups are found along the International and state boundaries- Mizos along Myanmar and Manipur- Cachar borders and Chakmas along Bangladesh border. People of similar stock are also found in Tripura. Such a dispensation makes the state politically very sensitive and economically fragile.

Concept of Agricultural Efficiency:
This explores the multifaceted concept of agricultural efficiency, highlighting its traditional definition as output per unit of input such as land, labor, or energy. It discusses various historical metrics used to quantify this efficiency, including yields per area, input-output ratios, and production per person employed. The text emphasizes that many conventional measures often overlook the environmental impact and resilience of ecosystems, which is crucial for sustainable agricultural productivity. Finally, it introduces more recent classifications like technical, allocative, and scale efficiency, while still underscoring the vital, yet often neglected, need to incorporate environmental constraints into a comprehensive understanding of agricultural effectiveness.

Scope of the study:
The scope outlines a study focusing on agricultural efficiency, particularly in the state of Mizoram, a hilly region where a significant portion of the population relies on agriculture despite challenging topography and limited cultivable land. The study proposes to analyze various physical and social factors influencing efficiency, such as farm size, irrigation, and population density, over two-time frames (1991-92 and 2006-07). It highlights increasing land fragmentation in Mizoram, leading to smaller holdings and declining agricultural efficiency, driven by a growing population and a lack of alternative employment opportunities. The research aims to understand how these combined attributes impact agricultural productivity in the region.

Aims and Objectives of the Study:

The aims and objectives of the study emphasize the importance of assessing agricultural efficiency in Mizoram, particularly given its spatially variable terrain. The goal of this assessment is to aid farmers and administrators in selecting suitable and economically viable crops. The author suggests that in challenging ecological conditions, sustainable farming practices should align with existing environmental conditions, rather than relying solely on increased inputs. This approach aims to promote agricultural sustainability by working within the environment's regenerative capacity. Therefore, the study necessitates examining various aspects of farming to understand why productive capacity remains low despite high monetary investment. This makes it imperative to correlate the following:

- To study the Pattern of Land use and production
- To assess Agricultural Intensity
- To assess input-output ratio in different administrative and environmental settings
- To measure Agricultural Efficiency and delineation of variable efficiency regions.

All the above must be studied independently particularly in the light of the fact that the land and production records at the level of farmers and related administrative bodies are poorly maintained (there is no cadastral survey in the state, prevailing system of shifting operational holdings makes maintenance of land and production records difficult). Changing land use policies of the government also does not help in having sound data base in the state. Thus, collection of information on the above and related aspects and their correlation provides a measure to **delineate agricultural efficiency regions** within the state of Mizoram.

Statement of problem:
The inefficiency of uniform agricultural input application and emphasizes the critical need for understanding spatial variability in farming. It argues that considering **geomorphic characteristics, soil fertility, and socioeconomic conditions** is essential for improving agricultural efficiency and minimizing environmental impact. Specifically, the document identifies **haphazard and non-scientific farming practices in Mizoram** due to a lack of information, prompting the need for careful policy and technology implementation. The text then outlines **key research questions and hypotheses** to investigate how factors like slope, input infusion, government subsidies, and farming system changes affect production and efficiency, while also considering environmental costs and regional disparities.

Hypotheses:
1. Farm outputs are positively correlated with the application of input
2. Slopes determine the farm input and output: lower the slope lower is the input and higher is the agricultural productivity in Mizoram and vice versa.
3. Institutional assistance has helped increasingly efficient use of land resources.

The hypotheses requiring evaluation to understand input and output efficiency in agriculture. It suggests space technology, like GPS and GIS, can provide crucial data on soil characteristics and crop yields. Such technologies are beneficial for monitoring various agricultural factors throughout the season, aiding in optimizing resource use and increasing profits. However, the document notes that precision farming adoption in Mizoram faces significant challenges, including limited information, unique land ownership, poor infrastructure, and farmer risk aversion. The proposed hypotheses will be tested using state-level samples.

Review of Literature:

More recently, particularly after 1950, revolutionary changes in statistical methods have refined the calculation of productive efficiency. Farrel (1957) introduced a method of input-output ratio to measure productive efficiency, considering inputs like land, labor, materials, and capital. He recognized the imperative to include factors like climate, location, and fertility in agricultural efficiency models, even if he couldn't include them himself. Hayami and Ruttan (1971) observed that agricultural growth relies on ecologically adapted and economically viable agricultural technology that continuously adapts to available resources. They noted that technical changes often aim to save labor or land, thereby increasing or maintaining productivity with fewer inputs. Kawagoe and Hayami (1985) further developed an index to compare agricultural efficiency, incorporating inputs such as labor, land, livestock, fertilizer, and machinery.
However, not all technological advancements have positive environmental outcomes:
• Gollop and Swinand (1998) found that agricultural efficiency in U.S. agriculture declined between 1980 and 1993 due to polluted water from the use of pesticides, which reduced productivity by 0.06%. This highlights the adverse impact of new technology on the agricultural environment.
• Kumar and Mittal (2006) observed a similar trend in India's Green Revolution from the mid-1980s, characterized by high input-use and decelerating productivity growth.
• Sun et al. (2011) revealed that while cultivated land productivity per unit area could be maintained, the agricultural ecological deficit increased, with a significant proportion from grassland ecological deficit and a slight increase in cultivated land ecological deficit. This suggests that the gap between input and output is closing very fast, indicating environmental strain.
• Gliessman (2001) challenges the notion that higher inputs always lead to a corresponding increase in output, stating that it "may go against the tolerance limit of the agro ecosystem". He equates agricultural efficiency with sustainability of the agroecosystem, advocating for minimal artificial inputs, internal pest management, and the system's ability to recover from disturbances.
Policy Considerations and Their Impact: The understanding of agriculture has evolved to include broader considerations beyond just output:
• Agriculture is increasingly influenced by human organization of space, including population, social attitude, technology level, and political systems. Its appropriate management requires individuals skilled in both biophysical and socio-economic backgrounds.
• The appropriate use and sustainable management of natural resources are fundamental for food security, poverty alleviation, and environmental quality.

• A critical gap in many traditional efficiency measures is their failure to account for "the resilience of the environment to cope up with the inducements to enhance agricultural productivity". This consideration is necessary for maintaining sustained agricultural productivity to meet both present and future demands.
• Farshad and Zinck (2001) define a sustainable agricultural system as one that is "politically and socially acceptable, economically viable, agro technically adaptable, institutionally manageable, and environmentally sound". These six requirements are considered the foundation for an efficient productive system.
• Catherine et al. (2012) reviewed how farms, beyond their primary production function, provide "public goods" such as soil management, biodiversity, water management, energy and carbon, and social capital. These "public goods" are believed to enhance productive efficiency, implying that policies supporting them can improve the balance.
• Sampaio (2013) links efficiency to sustainable development at the micro-level, aiming for cost minimization and output/profit maximization. Efficiency can be defined as technical efficiency (maximum output for given inputs), cost-efficiency (minimum cost for given output), or profit efficiency (maximum profit).
• Darkus and Malla et al. (2013) identified three complementary types of efficiency: technical efficiency (from current technology and management), allocative efficiency (price of farm products matching customer willingness to pay), and scale efficiency (production at minimum average cost correlated with land holding size). Policy frameworks can influence all these dimensions.
In essence, while technological advancements have aimed at maximizing agricultural output, they have often done so at the expense of environmental resilience through increased inputs and pollution. Policy considerations, on the other hand, are increasingly recognizing the need to define efficiency in a broader, more holistic way that includes environmental soundness, social acceptability, and institutional manageability to ensure long-term, sustainable agricultural productivity and safeguard the ecosystem.
Imagine agricultural output as a factory's production line and environmental resilience as the factory's foundation and surrounding ecosystem. Technological advancements, like new machines, can boost production significantly, but if they introduce pollutants or deplete resources faster than they can regenerate, they weaken the factory's foundation and harm the surrounding environment. Policy considerations, like building codes and environmental regulations, ensure that while production continues, the factory's structure remains sound and its operations don't destroy the ecosystem it relies on, thereby balancing immediate output with long-term viability.
Some notable contributions have been made by Chatterji (1952); Safi (1960, 1972, 1983); Grag (1964); Sapre and Despande (1964); Khusro (1964); Bhatia (1967); Hussain (1970, 1978); Singh and Chauhan (1977).

These studies can be classified into two groups:
1) Agriculture sector, and
2) Crop-specific analysis.

Different aspects of agriculture, therefore, have been of immense interest to the scholars from different disciplines for; they are believed to impinge on agricultural productivity hence efficiency of different regions differently. At the same time different approaches have been employed to assess agricultural productivity of different regions.

Methodology:

The methodology for a geographical study on agricultural efficiency in Mizoram. The authors note a shift from basic cartography to more quantitative methods to objectively assess agricultural productivity. Challenges in data collection are highlighted due to Mizoram's unique geography and lack of standardized cadastral surveys, necessitating the use of government-standardized information as a basis. The study primarily relies on primary data gathered through intensive field surveys and farmer questionnaires, supplemented by secondary data from government departments and statistical offices. Statistical analysis will be performed using SPSS and Excel.

Basis of selection of villages for the study:

This study investigated agricultural efficiency across three districts in Mizoram, India. Researchers gathered primary data through a comprehensive household survey, sampling 28% of households in twenty-seven selected villages. Districts were categorized by agricultural production (high, medium, low) to ensure representative insights into efficiency distribution. Within these districts, specific rural development blocks and villages were chosen, with a particular focus on the districts of Aizawl and Champhai. The collected data, which focused on factors like slope and inputs, was subsequently processed using SPSS for analysis.

Formula adopted for the present study:

For calculating the agricultural efficiency of the study area, the Data Envelopment Analysis (DEA) developed by Coelli (1996) has been chosen to identify the agricultural efficiency region. Coelli (1996) formula has been adjusted and used by Silva.E, Arzubi.A and Berbel.J in 2004 for Dairy farms in Azores, Portugal. The applied formula for measuring dairy farm efficiency in Azores is under:

$$E_{j} = \frac{U_1 \text{ litres of milk} + U_2 \text{ escudos of Subsidies}}{V_1 \text{ agriculture area} + V_2 \text{ cows number} + V_3 \text{ costs}}$$

The above formula is applied for measuring agricultural efficiency which required a little adjustment according to the applicability of the present study. The adjusted formula which has been applied to the present study is :

$$E_j = \frac{U_1\ kg\ of\ production + U_2\ Subsidies}{V_1\ agriculture\ area + V_2\ No.of\ Farmers + V_3 Costs}$$

If $E_j = 1$ which means the agricultural farms are efficient when compared with all the other farms, and when it is smaller than one, the agricultural farms are inefficient. (Silva.E, Arzubi.A and Berbel. J, 2004:pp 41). The above formula is the adjusted formula for the present study.
In the study area costs of production is counted as Rs 40/- which is taken as the average rate of all the crops. After applying the above formula, the study area is divided into three categories as Low, Medium and High. This categorization of groups is done by the process of subtracting the lowest production value recorded in the study area by the highest value which is divided by three as the study area is divided into three groups as low, medium and high category of agricultural efficiency. In order to calculate slope as a determining factor on efficiency, Linear Regression Method of Statistical Package for Social Sciences (SPSS) has been used and the formula is

$$y = a + bX$$

Where, y is the dependent variable
a is the intercept (the value of 'y' when X= 0)
b is the slope of the line
X is the explanatory variable

By following the above formula, the two variables have been entered in Statistical Package for Social Sciences (SPSS) and for analyzing the data, Linear Regression Method has been applied to get the results. After processing the data three tables have been shown which indicates the results for the variables entered.
The first table of interest is a model summary which provides us the "R" and "R^2" values. The "R" value represents the simple correlation of the two variables (the "R" Column) which indicates the exact degree of correlation. The "R^2" (the "R^2" Column) indicates how much of the total variations in the dependent variable which can be explain by the independent variable. The following table is just to show as an example on how the calculation has been interpreted.

Simple Correlation of Slope and Agricultural Efficiency

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.864[a]	.746	.710	.020361

The next table is the Anova table, which reports how well the regression equation fits the data (i.e. predicts the dependent variable). The table point out that the regression model predicts the dependent variables significantly well by looking at the "Regression" row and go to the "sig" column. This specifies the statistical significance of the regression model that was run. Value of the 'F' column denotes its significant level if the value of 'F' is statistically significant at a level of 0.05 or less, this suggests a linear relationship among the variable.

Level of Significance between Slope and Agricultural Efficiency

ANOVA[b]

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	.009	1	.009	20.551	.003[a]
	Residual	.003	7	.000		
	Total	.011	8			

a. Predictors: (Constant), Slope
b. Dependent Variable: Efficiency

The last table is coefficients table which provide us with the needed information to predict the dependent variable from the independent variable as well as to settle on whether independent variable contribute statistically significantly to the model by looking at the 'sig' column. Furthermore, we can employ the values in the 'B' column under the "unstandardized coefficients" column to present the regression equation of the values which is the expected value of the dependent variable when the values of the independent variables equal 0. The values in column 'B' represents the extent to which the value of that independent variable contributes to the value of the dependent variable. The 't' value makes known the variables statistical significance. In general, A 't' value of two (2) or higher indicates statistical significance.

Expected Value of the Dependent Variable

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	.306	.023		13.173	.000
	Slope	-.008	.002	-.864	-4.533	.003

a. *Dependent Variable: Efficiency*

Actual value may be correlated with the expected value by calculating 0.306-0.008 = 0.298. Therefore, the value 0.298 is the expected value of the dependent variable when the independent variable equals zero.
Slope degree has been calculated by the formula:

Slope_degree = ATAN (rise_run)*57.29578

Where, rise_run = $\sqrt{([dz/dx]^2+[dz/dy]^2)}$

The values of the centre cell and its eight neighbours determine the horizontal and vertical deltas. The neighbours are identified as letters from '*a*' to '*i*', with '*e*' representing the cell for which the aspect is being calculated.
Input output ratio is another criterion to judge efficiency of farm business. It refers to the ratio of input. (Bishop, C.E & Tousent, W.D,1958). It indicates relationship of expenses with return. Therefore, to measure the efficiency of agricultural fields, the computation of input output ratio is considered meaningful for this purpose. The following formula is used:

IOR = G1 ÷ Gg

Where IOR denotes input output ratio, G1 stands for the farm expenses and Gg symbolizes the production.

When input output ratio calculation is done, the Standard Deviation Method has been applied to get the categorisation of the three groups as low, medium and high category of the study area. The lowest input/output ratio is 0.11 which is subtracted by the highest ratio i.e. 0.27, 0.27-0.11 = 0.16 which is divided by 3 as the study area is divided into three categories of high, medium and low. 0.16/3= 0.05 and this value has been added to the lowest value i.e. 0.11+0.05 = 0.16, again 0.05 has been added to 0.16 i.e. 0.21….and so on. The village which having the value of upto 0.16 has been put in a low category, the value between 0.16 to 0.21 in medium category and the value above 0.21 in a high category group. The results declared that inputs do not have any influence on agricultural efficiency because when the inputs is high, automatically agricultural production is high, but that do not prove that high agricultural production with high inputs is high agricultural efficiency. Here, we have taken into consideration that less inputs with high agricultural production. All the inputs must be included in the measurement of efficiency.

AGRICULTURAL EFFICIENCY IN MIZORAM:

Efficiency based on Slope:
Based on sample studies of three District an attempt has been made to compare the agricultural efficiency with slope categories. To obtain the best possible result we went through to the Regression Method by using Statistical Package for Social Sciences (SPSS) and the obtained result shows that slope has an impact on the agricultural efficiency. This is because the villages having high agricultural efficiency level are found in the area surrounded by low slope degree and the area bounded by high degree slope does not have high efficiency. And it is also found that overall, the agricultural efficiency level is low in Mizoram due to the hilly and rugged terrain which existed in the state.
When slope is taken as the determining factor, 63.8 % of the agricultural efficiency can be explained to show the relationship of the variables for getting the concrete condition of the study area.
By looking into the "sig" column of the above table, we noticed the value of $p<0.001$ which indicates that over all the regression model statistically significantly predicts the outcome variable and in this light one came to know that slope has play a responsible role in efficiency. The above table suggested that there is a relationship between slope and efficiency.

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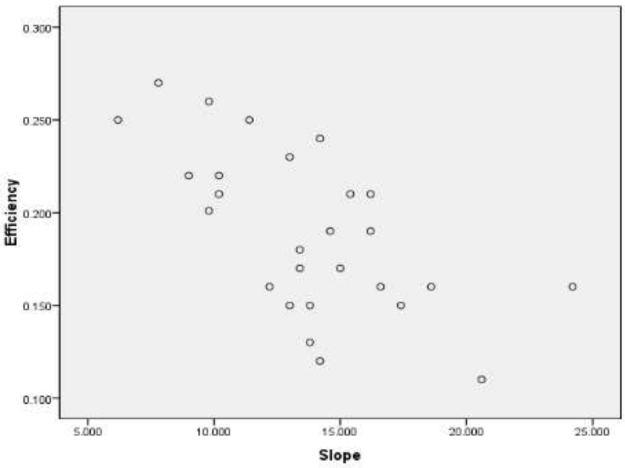
When one entered slope degree and agricultural efficiency in the software one come up to know that it is 99 % significance level proved.
The above table showed a high degree of correlation existed between slope and efficiency; (0.288 -0.007 = 0.281). And the value of 0.281 is the expected value of the dependent variable when the values of the independent variables equal zero. It is proved that slope and efficiency have a high relation with 99 % significance level.
From the above equation, slope has a negative impact on efficiency. If the slope degree decreases the production increases. The area which lies in the lower slope degree has a higher production and the agricultural efficiency of the land also high. Table No. **5.37** represents how slope influence efficiency of the study area which will later be shown in the following table to make the picture more clearly.

Mizoram: Distribution of Agricultural Land on different Slope Categories and Agricultural Efficiency of the villages

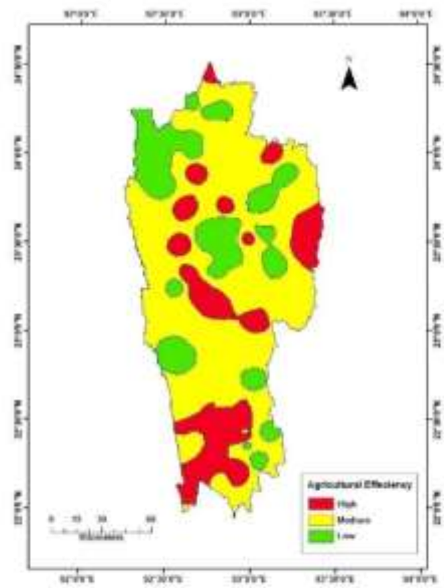
	Slope in Degrees					
Villages	**0-10**	**10-20**	**20-30**	**30-40**	**>40**	**Efficiency**
Tualcheng	22	3	-	-	-	0.22
Vapar	14	9	2	-	-	0.25
Selam	7	10	6	2	-	0.21
Puilo	4	11	7	3	-	0.16
Kawlkulh	5	14	6	-	-	0.21
Chalrang	5	12	8	-	-	0.19
Ngopa	6	17	2	-	-	0.18
Changzawl	-	21	4	-	-	0.16
Champhai	19	5	1	-	-	0.27
Sailam	5	17	3	-	-	0.12
Vanbawng	7	18	-	-	-	0.16
Tlungvel	3	22	-	-	-	0.13
Phulpui	-	15	6	4		0.11
Phullen	8	14	3	-	-	0.15
Thingsulthliah	15	8	2	-	-	0.20
Sialsuk	9	10	6	-	-	0.15
Maite	12	13	-	-	-	0.21
Khawlian	16	8	1	-	-	0.22
Serkawr	3	14	7	1	-	0.15
Rawmibawk	6	13	6	-	-	0.24
Kawlchaw	10	11	4	-	-	0.23
Chhuarlung	-	11	5	9		0.16
Phura	14	10	1	-	-	0.26
Zeropoint	6	19	-	-	-	0.25
Zawngling	4	21	-	-	-	0.17
Maubawk	5	17	3	-	-	0.20
Chapui	5	16	4	-	-	0.19

It appears from the above table that the settlements having larger proportion of agricultural lands on slopes lower than 20^0 have relatively larger productivity than the cultivated lands above 20^0. And thus, proved that slope has an influence on agricultural efficiency.

Relationship of Efficiency with Slope Categories
However, there appears to be spatial productivity variations correlated with slope when it is analysed. The following table shows the productivity variations in relation to the slope categories in sampled villages.



Mizoram: Agricultural Efficiency based on Slope



Agricultural Efficiency	Villages
High	Tualcheng, Vapar, Selam, Champhai, Khawlian, Rawmibawk, Kawlchaw, Phura, Zeropoint
Medium	Kawlkulh, Chalrang, Ngopa, Maite, Maubawk
Low	Puilo, Changzawl, Sailam, Vanbawng, Tlungvel, Phulpui, Phullen, Thingsulthliah, Sialsuk, serkawr, Chhuarlung, Zawngling, Chapui

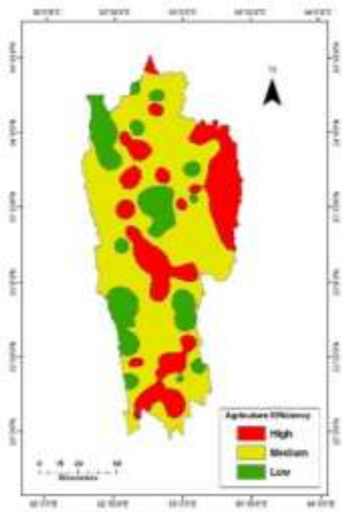
Efficiency Based on Input/Output Ratio.
When input is taken as the determining factor on agricultural efficiency, following the equation it is proved that input do not have any contact on agricultural efficiency. Agricultural efficiency is basically termed as high agricultural production in the company of low inputs, however, in the study area where we find high production at the same time their inputs worth is also high and that cannot be add up as a high efficiency region. A large quantity of expenses does not grant a high efficiency.

Mizoram: Input and Output Ratio with Efficiency

Villages	Input	Output	Ratio	Efficiency
Tualcheng	201250	782840	0.25	**0.22**
Vapar	229530	809600	0.28	**0.25**
Selam	253500	1111560	0.22	**0.21**
Puilo	291750	839200	0.34	**0.16**
Kawlkulh	257800	1041400	0.24	**0.21**
Chalrang	327250	1010080	0.32	**0.19**
Ngopa	239780	1068240	0.22	**0.18**
Changzawl	465250	1262120	0.36	**0.16**
Champhai	213250	999440	0.21	**0.27**
Sailam	915730	1314400	0.69	**0.12**
Vanbawng	1267000	2069480	0.61	**0.16**
Tlungvel	1386537	2122280	0.65	**0.13**
Phulpui	932730	1324200	0.70	**0.11**
Phullen	1151879	1711280	0.67	**0.15**
Thingsulthliah	2053400	2714680	0.75	**0.20**
Sialsuk	1410800	2137240	0.66	**0.15**
Maite	955640	1498520	0.63	**0.21**
Khawlian	942450	1283600	0.73	**0.22**
Serkawr	205500	577280	0.35	**0.15**
Rawmibawk	197250	572200	0.34	**0.17**
Kawlchaw	294750	812000	0.36	**0.23**
Chhuarlung	407250	972840	0.41	**0.16**
Phura	252500	837200	0.30	**0.26**
Zeropoint	285000	849480	0.33	**0.25**
Zawngling	217043	518520	0.41	**0.17**
Maubawk	217500	917880	0.23	**0.24**
Chapui	419500	1010800	0.41	**0.19**

The table above provides us an initiative about those villages which have a high input automatically do not have a high agricultural efficiency. A high input undoubtedly gives the high production but that could not be add up as a high agricultural efficiency. The category of the three groups has been prepared by Standard Deviation method and the red colour on efficiency column indicates the high category, the blue colour indicates the medium category whereas the black colour indicates the low category. The villages which are clustered in a high category of agricultural efficiency has a lower input whereas the villages clustered into a low category has a high input but still having a low efficiency. Here, we have the result that input, and efficiency do not have a relationship. Efficiency is put in simple words as high production with less input. Keeping this in mind, agricultural efficiency is less expenditure with high production. In this paper, we make a conclusion that over all the agricultural efficiency is low in the study area due to high degree of slope. Even if high inputs be happening, the efficiency level is still very low. To overcome this or to improve the agricultural efficiency level there are some steps which we must bring to accomplish.

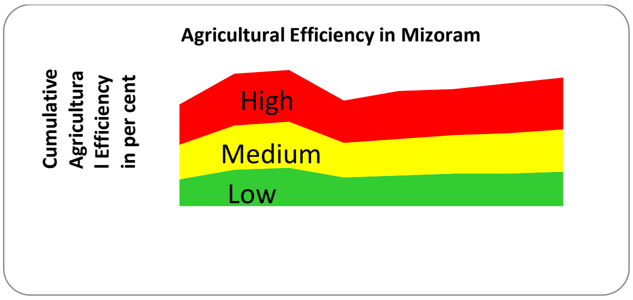
MIZORAM: Agricultural Efficiency
(based on Input/Output)
The District wise distribution of agricultural efficiency occupied by the three category.



Districts	Low	Medium	High
Aizawl	14	18	21
Champhai	19	23	27
Kolasib	20	24	27
Lawngtlai	15	18	22
Lunglei	16	19	25
Mamit	17	20	24
Saiha	17	21	26
Serchhip	18	22	27

Cumulative Agricultural Efficiency in Mizoram

From the above investigation on agricultural efficiency of Mizoram, we came to realise that overall, the agricultural efficiency is low this is not only due to the hilly terrain but also the low literacy among the farmers. Mostly the farmers being interviewed are illiterate and this upshot that they do not have any knowledge in selecting the field which is best for any crops. Apart from that due to the lack of knowledge on how to implement a modern technology on their field in turn result in low production. And the educated youth people among the family do not make much contribution on agriculture instead they moved out to the nearby town hoping to get a better living standard. If there is the involvement of young, educated people, the production may increase to some extent. By this we came to make a conclusion that the Institutional assistance has helped increasingly efficient use of land resources.



SUMMARY AND CONCLUSION

Societal issues (and agricultural efficiency is one such) observes (Lichtfouse (2009:11) cannot be resolved separately and individually in "which an individual problem is solved by an individual solution. Such an approach does not work anymore for two reasons, at least. First, all systems, mechanisms, and activities are closely intertwined. For instance, food production is closely linked to health, climate change, transportation, market, finance, and politics. Therefore, applying a remedy to only one element of this system will not work because the remedy will induce negative impacts on other elements in the end. Only solutions that consider the whole system and its connections will have a chance to succeed now". It may well be understood by a study conducted in respect of rice cultivation in India and particularly with reference to the state of Kerala, a major rice growing state in the country. Suchitra (2015:106-109) observes that increasing use of high yielding varieties of seeds (success of which depends largely on chemical inputs (fertilizers and pesticides) supported by corresponding input of water and labour) though is believed to have increased the rice yield by leaps and bounds from 668 kg/ha in 1950 to roughly 2468 kg/ha in 2013-14 India is showing signs of exhaustion". Bhalla (2014:6-7) also acknowledges the fact that by the early 1980s, the possibilities of extending net sown area were beginning to get exhausted. Since then, Net area sown and cultivated area have been contracting because there was a substantial increase in area under non-agricultural uses which could not be compensated for by reductions in barren land, land under miscellaneous tree crops and culturable wasteland. In this process, while some good quality land was lost to non-agricultural uses, cultivation was extended, increasingly, to poorer quality land. As a result, the nation, it is reported, has lost about 1.25million hectares of rice lands only between 2011-12 and 2013-14 due to monetary non-viability of the crop under relative inefficiency of

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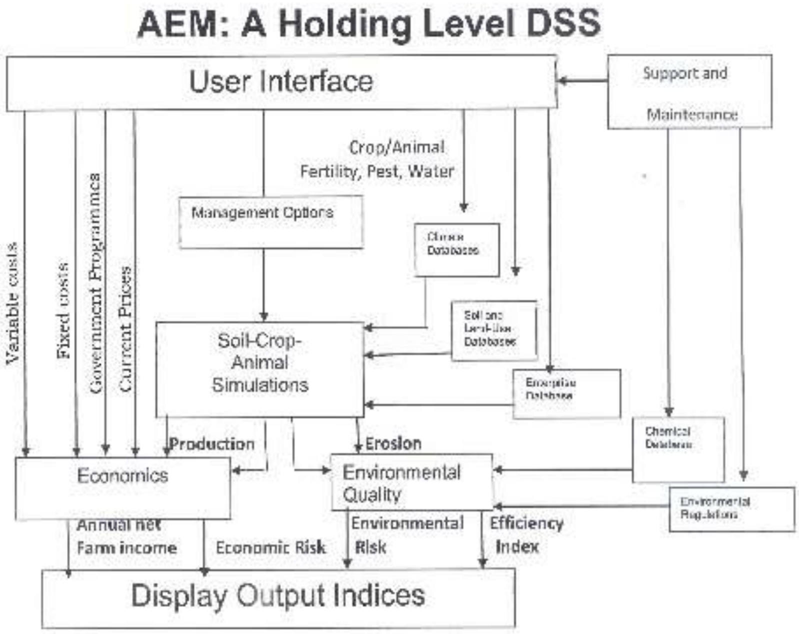
land as under obtained environmental condition and pushed by government policies. It may not be out of place to refer to Radhkrishna (2009) who identified two 'dimensions' of agricultural distress - an 'agricultural development crisis, (reflected in low growth, declining profitability of agriculture), and an agrarian crisis (reflected in growing landlessness and casualisation of labour in agriculture, unchecked proliferation of small and marginal holdings, fragmentation of land holdings, and widening gap between rural and urban areas') all reflecting on the national efficiency of agriculture. A study in Kerala, a major rice growing state, suggests that about 76 % of the rice land has been diverted to different land uses in last 40 years. It is estimated that of about 875000 ha area under rice cultivation in 1970 only about 208000 ha are available for rice cultivation in the state. Major cause of depletion of rice land is attributed to mismatch between output and rising costs of input showing low or no profitability despite higher yield per unit cultivated land. Such an outcome requires a systematic study of the components that impact as well as are impacted upon by agricultural practices and ongoing quest for their enhanced efficiency. There seems to be disproportionately a deliberate attempt on the part of the propagators of enhanced productivity to emphasize the need to enhance production/productivity to meet the requirements of the ever-increasing population. They seem to overlook that on global as well as national level the total food grain production is about three times more than the present requirements. The problem being cited is not about availability of food, it is about the expansion of agro-based industries and diversion of crops for meeting the energy needs as highlighted in introductory chapter. Besides, proponents equating efficiency with productivity/ production tend to deliberately overlook the environmental consequences of economically more profitable large-scale monoculture. They also seem to avoid the fact that large areas under different agro-climatic regions (an essential component in the evaluation of natural efficiency of agriculture) are being diverted for non- agricultural use year after year to meet the requirement of industries and process of urbanization. Both misleadingly advocated to be bringing about development against numerous studies and World Development Reports that such expansions have been aiding concentration of wealth and econo-political power against the expansion of common men's wellbeing.
Considering the case of Mizoram from obtained conditions, thus, raises questions about the understanding and definition of agricultural efficiency in the state.
This necessitates identifying the different significant components that may be impinging on the efficiency of agriculture in the state. It is in this light that a flow chart following Ahuja et.al. (2002) and showing the relationship amongst different significant components of agriculture in the state has been prepared as shown below.

Relationship of Different Components of Agriculture



AEM= Agricultural Efficiency Management
DSS= Decision Support System

Thrust Areas for Future Research:
The potential areas for future agricultural research, particularly in the Mizoram region, building upon the limitations of a previous study. It suggests investigations into the diversion of agricultural land for non-agricultural purposes, examining the causes, economic, social, and environmental impacts, and the resulting changes in land productivity and ecosystem

resilience. Additionally, the text proposes studying consumer behaviour and its influence on agricultural land use patterns, including the shift from subsistence to commercial farming and the allocation of food crops for animal feed or energy production. Finally, it recommends exploring changes in the quantity and quality of calorie and nutrient values in agricultural output, considering the effects of efforts to enhance productivity on land quality over time.

Suggestions:

Several important recommendations for enhancing agricultural efficiency in Mizoram, focusing on leveraging its natural and human resources. The suggestions emphasize the need for a more interconnected agricultural system, requiring high-resolution experimental data and comprehensive, shared databases with standardized protocols. It also highlights the importance of compatible parameters across different scales to aggregate simulation results effectively. Furthermore, the text advocates for mechanisms to update scientific knowledge and databases regularly, alongside improved communication and coordination among all stakeholders, including model developers, field scientists, and farmers. Finally, the document identifies an urgent need to address significant knowledge gaps concerning agricultural management, plant responses to stress, and the effects of natural hazards.

Conclusion:

The challenges faced by farmers in a specific remote, mountainous region, highlighting how socio-economic and physical characteristics contribute to low agricultural productivity. Key issues identified include limited access to education and new technologies, inadequate financial assistance from banks and government, and the pervasive use of outdated farming methods. The document also points to environmental concerns like deforestation from shifting agriculture and soil erosion, exacerbated by a lack of proper inputs such as fertilizers and pesticides. Ultimately, the text advocates for government and private sector intervention through partnerships, training, and improved financial infrastructure to empower farmers and enhance their efficiency.

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