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### Irrigation infrastructure and rural development: a study in Karbi Anglong autonomous council area of Assam

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#### Abstract

Rural infrastructure plays a pivotal role in socio-economic status of rural population. Irrigation infrastructure has paramount importance in improving agricultural productivity, cropping pattern and crop diversity which results in well-being of rural community. This paper makes an analysis about the status of irrigation infrastructure and its impact on agricultural activities in the rural areas administered by Karbi Anglong Autonomous Council. The study has used both primary data and secondary data for a period of five years from 2013-14 to 2017-18. The paper finds no significant impacts of existing irrigation plants on income and agricultural activities of rural population. It also finds that maintenance of irrigation plants is not enough and strong. There is lack of good maintenance system of existing irrigation system.

**Keywords:**1 Infrastructure,2 Irrigation,3 Rural Development,4 Karbi Anglong Autonomous Council

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#### 1. [Introduction](#)

In country like India, rural infrastructure is the most important and essential sector on which growth and development of the rural India depends. Socio-economic status of rural people is accelerated if this sector prospers. Infrastructures like power, credit, irrigation, marketing facility, transport etc are essential requirements for rural development. Out of these infrastructures, irrigation infrastructure plays a pivotal role in the development of the rural areas where population mainly depends on agriculture. Adequacy of irrigation accelerates the process of agricultural development by increasing productivity and cropping pattern. It has paramount importance in promotion of agriculture sector. Irrigation infrastructure contributes to economic growth and poverty alleviation by increasing agricultural productivity as well as income and thereby, improves socio-economic status of rural people. In India, since the inception of economic planning, priority has been given in expansion and development of agriculture by implementing various schemes and programmes. The present paper analyses the existing irrigation infrastructure development and its effect on rural households by examining agricultural productivity, cropping pattern and crop diversity in KAAC area.

#### 2. [Data and methodology](#)

##### 2.1 [Data Sources](#)

Based on both primary and secondary sources, the paper is analytical in nature. Secondary data on irrigation infrastructure development indicators have been obtained from Statistical Handbook of Assam, District Census Handbook, Karbi Anglong and Souvenir, KAAC for the period from 2013-14 to 2017-18.

The rural areas administered by Karbi Anglong Autonomous Council comprise the universe of the study. The study is carried out in Howraghat and Bokajan development blocks of East Karbi Anglong district. Three stage sampling method has been applied to select the sample blocks and sample villages. There are seven development blocks in east Karbi Anglong district. In the first stage, purposive sampling method has been applied to select the development blocks. Two development blocks out of seven blocks have been selected. At the second stage, out of 801 villages (449 in Bokajan block+352 in Howraghat block= 801 villages), 40 villages (5% of total villages) have been randomly selected. At the third stage, two respondents are randomly selected from each village. Thus, a sample size of 80 (40×2=80) respondents is selected for the purpose. The respondents have been selected by adopting random sampling technique.

## 2.2 Irrigation Infrastructure Development Indicators

Irrigation infrastructure development and its impact on welfare of households have been measured using availability and utilisation indicators of irrigation. Thus, following indicators are taken into consideration to analyse the development of irrigation facility:

- a) Percentage of gross irrigated area to gross cropped area to net irrigated area,
- b) Area utilised by major, medium projects and minor irrigation schemes
- c) Impact of irrigation on agricultural productivity, cropping pattern and crop diversification among sample respondents.
- d) Increased use of HYV seeds.

## 2.3 Operational concepts of the terms used

**Infrastructure:** The basic facilities and services needed for a country, state or city to function its economy is collectively known as infrastructure. (Wikipedia, 2020) Both physical or economic and social infrastructures are essential for sustainable socio-economic development. Energy, telecommunication, transport, finance etc. are included in physical infrastructure while education, health, family welfare schemes like sanitation, safe drinking facility, housing, civic utilities, culture are regarded as social infrastructure.

**Irrigation:** Irrigation is one of the most important catalysts in agricultural productivity. According to Cambridge Dictionary, the practice of supplying land with water so that crops and plants can grow is irrigation.

## 2.4 The Study Area

The study is carried in Karbi Anglong Autonomous Council administrative area. It is one of the hill regions of Assam state in North-east India. There are two districts under KAAC namely, East Karbi Anglong and West Karbi Anglong. There are 11 blocks (7 blocks in East Karbi Anglong and 4 blocks in West Karbi Anglong) and 2928 villages in KAAC administrative area. (<https://karbianglong.gov.in>)

Geographically, the study area lies between 25°33' N to 26°35' N Latitude and 92°10' to 93°50' E Longitude and is in the south-east part of Assam. The total geographical area of the districts is 10,434 sq. k.m. The total population of Karbi Anglong is 9,65,280 according to 2011 Census. The density of population is 92 per sq. k.m. Out of total population, male population is 4,93,482 and female population is 4,71,798 giving a sex ratio of 951. The population mainly consists of the tribes like Karbi, Bodo, Dimasa, Kachari, Kuki, Rengma Naga, Garo, Tai Aiton, Tai Turung etc. Among them, Karbi is the main tribe living in the study area. The economy of Karbi Anglong is predominantly agrarian. More than 85% of the population directly depends on agriculture for their livelihood. In the hilly areas, people use to practise shifting cultivation. (District Census Handbook, 2011, Karbi Anglong)

### 3. Literature Review

Datt and Ravallion (1998) conducted an analysis to examine firm productivity and rural poverty in India. They show that irrigation and other infrastructure developments have enhanced firm productivity. The growth of agricultural productivity is higher in the states with better infrastructure including irrigation. Consequently, it has played a significant role in reduction of rural poverty. They have shown that the states endowed with better investment in physical as well as human infrastructure have done well in growth process and can alleviate poverty. They opined that infrastructure facilities such as safe drinking water, sanitation, electricity, health centres and roads are very crucial for well-being of people.

Bhatia (1999) has analysed the relationship between rural infrastructure and agricultural growth. He has found a strong positive relationship between rural infrastructure index and food grain productivity per hectare in India. The rural infrastructure index is a composite measure comprising rural electrification, roads, transport, health, irrigation, farm credit, fertiliser, agricultural marketing, research and extension. The study shows that states with highest rural infrastructure index such as Punjab, Haryana and Tamil Nadu have the highest food grain productivity per hectare and the states such as Rajasthan, Bihar and Madhya Pradesh with lowest rural infrastructure index have the lowest food grain productivity per hectare.

Narayanamoorthy (2001) conducted a quantitative study using data at four different points of time during 1970s and 1980s to show the importance of irrigation in poverty alleviation. His study covers 14 major states of India. Using irrigated area in hectare per thousand rural population, he has measured irrigation infrastructure development and examines its effect on real wage of labourers, and food grain production. The study finds that there is positive correlation between real wage of agricultural labourers with development of irrigation. It also finds a positive impact of irrigation on foodgrain production per head of rural population.

Ashok and Balasubramanian (2009) made a study in the districts of Tamil Nadu during the period from 1998-99 to 2003-04 to analyse the effects of infrastructure on agriculture productivity. They have employed total productivity approach in their study. The study found that irrigation, roads, markets and literacy had positively effected in productivity.

Gebregziabher et.al.(2009) made a study to evaluate the impacts of access to small-scale irrigation on farm household's poverty status and overall socio-economic enhancement by taking a representative sample of 613 farm households (331 irrigators and 282 non-irrigators) drawn using three-stage stratified sampling in Tigray, Ethiopia. The study finds that the average income of non-irrigating households is less than that of the irrigating households by about 50%. The overall average income gain due to access to irrigation ranges from 4000 Birr to 4500 Birr per household per annum. The study also finds that farming income is more important to irrigating households than to non-irrigating households, and off-farm income is negatively related with access to irrigation.

Beero and Narayanamoorthy (2014) have conducted a descriptive analysis to examine variation in rural poverty in irrigated and un-irrigated area using primary data collected during 2013-14 from villages of Tamil Nadu using simple random technique. The study has found that employment days, income and consumption of the households are higher in irrigated villages as compared to un-irrigated villages. The study also found that the number of households below poverty line and the number of population below poverty line are higher in un-irrigated villages. The study has emphasized that irrigation is a crucial factor in reducing poverty.

### 4. Objectives

1. To examine the status of irrigation infrastructure in rural areas administered by KAAC.
2. To examine the impact of irrigation on agricultural productivity and cropping pattern.
3. To examine the effectiveness of infrastructure development in regard to irrigation on life of rural people.

### 5. Significance of the Study

Agriculture is the main occupation of rural people of KAAC area. More than 85% of the population directly depends on agriculture for their livelihood.(Census, 2011) Socio-economic development of rural population is, therefore, closely related to the development of agriculture. . Rural poverty and overall socio-economic development of rural population can be effectively addressed by increased productivity in agriculture to a greater extent. None can deny that for agricultural productivity irrigation infrastructure is inevitable. KAAC has implemented various schemes to develop irrigation infrastructure to promote agricultural productivity which can result in increase in income of rural population, poverty reduction as well as rural development. However, no attempts have been executed to analyse whether these schemes have achieved their objectives of agricultural development, poverty reduction and over-all socio-economic

development of rural population. Therefore, in this study an attempt has been made to analyse the existing irrigation infrastructure in KAAC area and its effectiveness in agricultural productivity and cropping pattern.

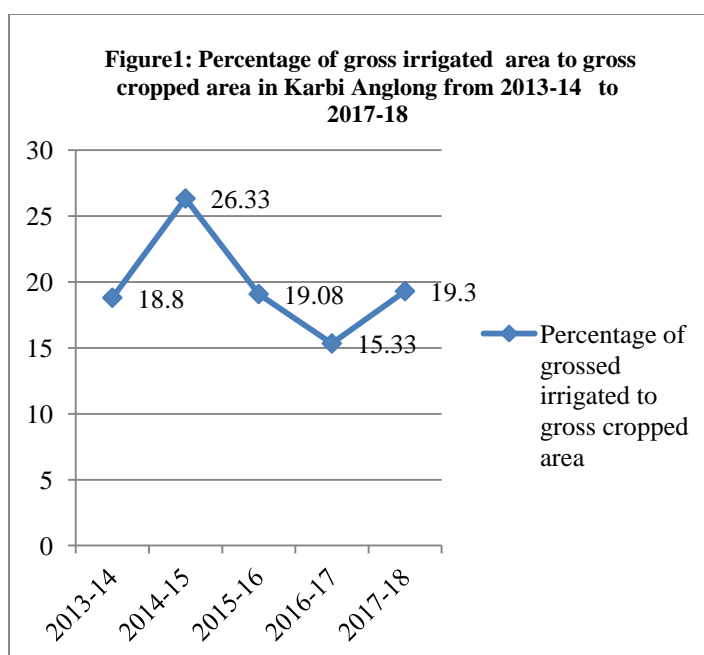
## 6. Results and Discussion

**6.1 Development of Irrigation Infrastructure in the Study Area -** Irrigation is the most important and essential infrastructure to accelerate the path of economic development of any region. The people of this hilly area are mainly dependent on cultivation for their livelihood. Irrigation is an essential practice for agriculture development of the poor farmers. The irrigation department under the KAAC has been implementing different types of irrigation schemes like Flow irrigation schemes, Lift irrigation schemes, Tank irrigation schemes, Deep Tube Well, Shallow Tube Well etc. to provide required irrigation facilities for the benefit of the farmers. In east and west Karbi Anglong districts, there is no major irrigation project. Table 1 shows details in regard to gross irrigated area, net irrigated area and percentage of gross irrigated area to gross cropped area in the study area during the period from 2013-14 to 2017-18.

**Table1: Development of irrigated area from 2013-15 to 2017-18** (Area in hect.)

Year	Gross Area under Irrigation	Gross Cropped Area	% of Gross Irrigated Area to Gross cropped area	Net Area under Irrigation
2013-14	38088	202564	18.80%	27067
2014-15	65176	247522	26.33%	40760
2015-16	40054	209910	19.08%	21197
2016-17	38422	250515	15.33%	22140
2017-18	48200	249640	19.30%	31337

Source: Statistical Handbook of Assam from 2015 to 2018, Souvenir, KAAC



In the year 2013-14 gross irrigated area was 38088 hectares in Karbi Anglong. It accounted 18.80% of the gross cropped area. In 2014-15 the percentage of gross irrigated area to gross cropped area increased to 26.33%. Again, the percentage of gross irrigated area to gross cropped area decreased to 19.08% in 2015-16. It has further decreased to 15.33% in 2016-17. Then, in 2017-18 the percentage of gross irrigated area to gross cropped area has increased to 19.30%. Thus, it is seen that in the study area the percentage of gross irrigated area to gross cropped area has fluctuated during the period from 2013-15 to 2017-18. It is also seen from the table that net irrigated area in Karbi Anglong in 2013-14 was 27067 hectares. In 2014-15 it was 40760 hectares. It has decreased to 21197 hectares in 2015-16. Again, in 2016-17 and 2017-18, net irrigated area was 22140 hectares and 31337 hectares respectively.

### 6.2 Net Irrigated Area in Karbi Anglong:

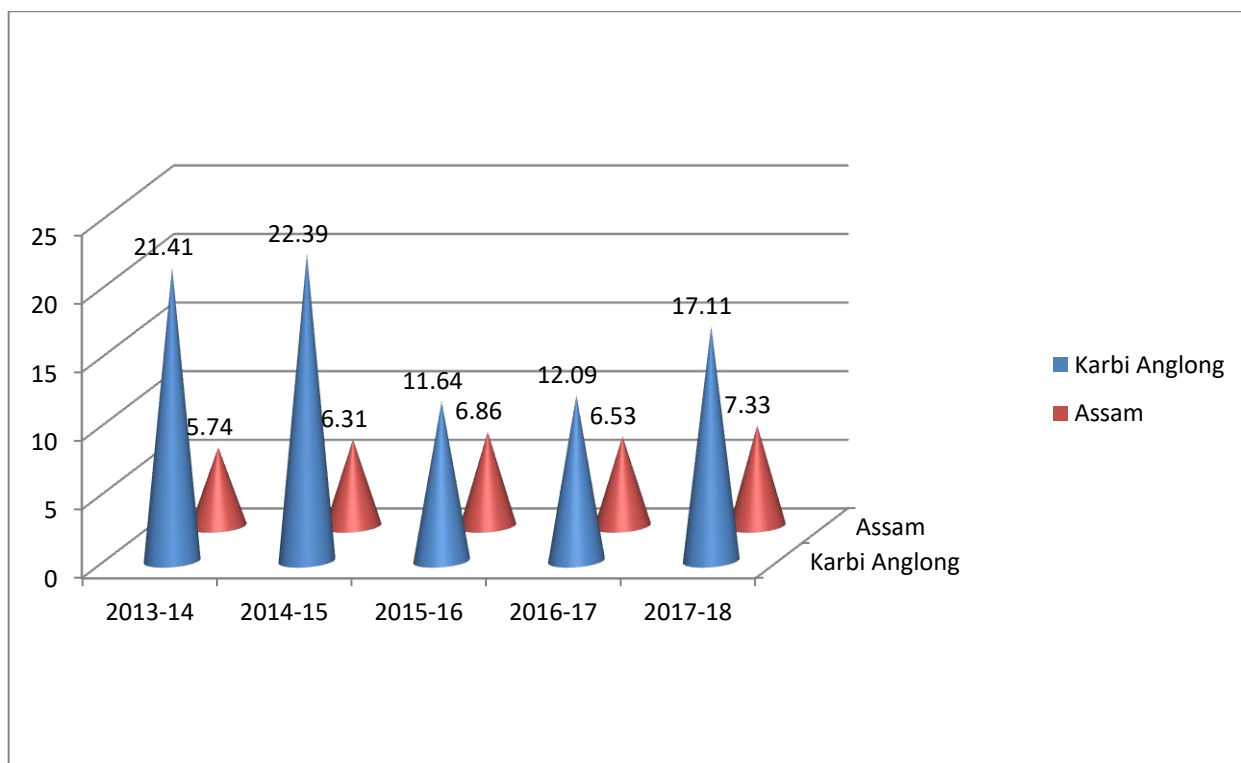
Table 2 presents data in regard to net irrigated area net cropped area in Assam and Karbi Anglong and percentage of net irrigated area to net cropped area in Karbi Anglong and Assam during the study period to make a comparative study of irrigation infrastructure development in the study area with that of the state. It is observed that the percentage of net irrigated area to net cropped area during the period from 2013-14 to 2017-18 in Karbi Anglong is higher than that of Assam State. In 2013-14 it was 21.41% in Karbi Anglong while it was only 5.74% in Assam state. Likewise, in the later years also same trend is observed. In 2017-18 the percentage in Karbi Anglong is 17.11% and in Assam state it is 7.33%.

**Table:2 Net Irrigated Area in Karbi Anglong and Assam** (area in hect.)

Year	Net irrigated Area		Net cropped area		% of Net irrigated area to net cropped area	
	Karbi Anglong	Assam	KarbiAnglong	Assam	Karbi Anglong	Assam
2013-14	27067	161398	126399	2810597	21.41	5.74
2014-15	40760	178651	182020	2827324	22.39	6.31
2015-16	21197	192218	182020	2801472	11.64	6.86
2016-17	22140	181355	183125	2773855	12.09	6.53
2017-18	31337	206293	183125	28.11 lakh	17.11	7.33

Source: Statistical Handbook of Assam from 2014 to 2018, Souvenir from 2016 to 2019, KAAC

**Figure2: PC of Net irrigated area to net cropped area in Karbi Anglong and Assam**



**6.3 Area Utilised By Major, Medium Projects And Minor Irrigation Schemes:**

Table 3 presents data pertaining to area actually utilized by major, medium projects and minor schemes in Karbi Anglong from the period from 2013-14 to 2017-18. It is observed that there is no major irrigation project implemented in the districts during the study period.

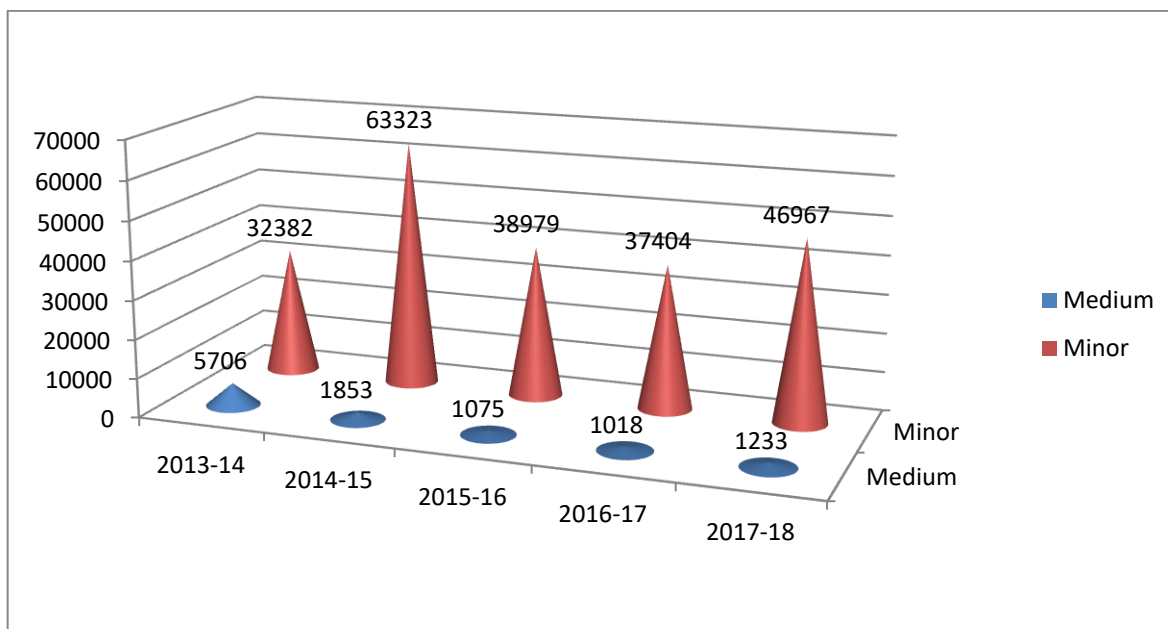
**Table3: Area utilised by major, medium projects and minor irrigation schemes**

( Area in hect.)

Year	Projects/ Schemes.			Total
	Major	Medium	Minor	
2013-14	-	5706	32382	38088
2014-15	-	1853	63323	65176
2015-16	-	1075	38979	40054
2016-17	-	1018	37404	38422
2017-18	-	1233	46967	48200

Source: Statistical Handbook of Assam from 2014 to 2018.

**Figure 3: Area utilised by major, medium projects and minor irrigation schemes**



During the study period, area irrigated by medium project is highest in 2013-14 (5706 hectares). In 2016-17, the areas irrigated by medium project is 1018 hectares and it is lowest during the period from 2013-14 to 2017-18. In 2014-15 and 2015-16, medium projects irrigated 1853 hectares and 1075 hectares respectively. It is also observed that areas irrigated by minor irrigation schemes are higher than the areas irrigated by medium projects. In 2014-15 highest areas (63323 hectare) are irrigated by minor schemes during the study period.

**6.4 Views Of The Respondents In Regard To Irrigation Development:**

Development of irrigation infrastructure helps to improve the grossed cropped area, agricultural productivity, crop diversification and cropping pattern thereby making cultivation beneficial to the farmers. KAAC has implemented various schemes to develop irrigation infrastructure to promote agricultural productivity which can result in increase in income of rural population, poverty reduction as well as rural development. However, few attempt has been done to analyse whether these schemes have achieved their objectives of agricultural development, poverty reduction and over-all socio-economic development of rural population. Therefore, to analyse the effectiveness of these programmes on agricultural development and overall socio-economic development, the respondents have been asked about availability of irrigation facility, impact of irrigation on agricultural productivity, use of HYV seeds, cropping pattern, crop diversification and adequacy of irrigation. It is observed that irrigation facility is not enough in the study area. Majority of farmers (78.75%) are not

benefitted by govt. irrigation schemes. They depend mostly on rainwater for cultivation. Table 4 reveals the views of farmer respondents regarding irrigation facility available in the study area.

**Table4: Opinion of respondents regarding irrigation infrastructure (N=80)**

Components	Yes	No
Development has been carried out in irrigation system in rural areas during the period 2013-14 to 2017-18.	14 (17.5%)	66 (82.5%)
Govt. irrigation schemes have benefitted the farmers	17(21.25%)	63(78.75%)
Positive impact of irrigation facilities on agricultural productivity & agricultural income	11(13.75%)	69 (86.25%)
Positive impact of irrigation facilities on use of HYV seeds, crop diversification and cropping pattern	3(3.75%)	77(96.25%)
Irrigation infrastructure provided by govt. is adequate in the study area.	5(6.25%)	75 (93.75%)

Source: Author's compilation from survey

## 7. Major Findings

- The percentage of gross irrigated area to gross cropped area in undivided Karbi Anglong has fluctuated during the period from 2013-14 to 2017-18.
- The percentage of net irrigated area to net cropped area during the period from 2013-14 to 2017-18 in Karbi Anglong is higher than that of Assam State. It is observed that there is no major irrigation project implemented in the districts during the study period. Areas irrigated by minor irrigation schemes are higher than the areas irrigated by medium projects.
- Out of total farmer respondents, majority of farmers (78.75%) are not benefitted by govt. irrigation schemes. They depend mostly on rainwater for cultivation.
- 86.25% of the respondents have opined that there is not any desired increase in agricultural productivity due to the irrigation facility provided by the council.
- Impact of irrigation facility on use of HYV seeds, crop diversification and cropping pattern among the respondents is not satisfactory.

## 8. Conclusion

The present paper examines the availability and utilisation of irrigation infrastructure in the study area and its impact on rural households by increased agricultural development. Analysis of data during the period from 2013-14 to 2017-18 shows that there is increase in the coverage of irrigation facility in the study area. But, observation from primary data shows that there is no significant effect of irrigation infrastructure in improving rural household's agricultural productivity and crop diversification. This implies that contrary to the observation from secondary data, the irrigation infrastructure is not sufficiently and effectively working in the study area. The rural areas have inadequate irrigation infrastructure both in terms of availability and utilisation.



The study gives emphasis on making the irrigation infrastructure available uniformly in rural areas to support rural agricultural activities. A growing irrigation infrastructure is far more important for development of agriculture to boost rural economy in Karbi Anglong. Therefore, the concerned authority should take necessary steps to overcome the weaknesses in operation and maintenance of irrigation infrastructure for balanced rural development. Besides, coverage of irrigation facility should be expanded.

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