

## Small Scale Irrigation in Ghana: Challenges and Prospects in the Face of Climate Variability

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### ABSTRACT

*Smallholder or informal or small scale irrigation is one of the three broad categories into which irrigation is put in Ghana. Faced with climate change and variability resulting in extreme events, irrigation serves as insurance against crop failure and permits all-year-round production. The study was carried out to underscore the challenges and prospects of small scale irrigation in the face of climate variability in Ghana and to propose the way forward. The key source of data for this study was secondary data which were collected mainly by reviewing published reports, policy documents, articles, online sources and official web sites of relevant state and international institutions. A number of challenges confront small scale irrigation development including high cost of energy, encroachment on irrigation lands, illegal mining activities and lack of technological know-how among others. Small scale irrigation has a promising future owing to renewed collaborative spirit GIDA has with major stakeholders. To forestall encroachment on irrigation lands, we recommend amendment of Irrigation Development Authority Act to empower GIDA to exercise absolute control over irrigation lands. It is also recommended that the Authority collaborates with relevant stakeholders to develop effective programmes for building capacity of contractors involved in development of irrigation infrastructure. To overcome the challenge of high cost of energy, it is recommended that government makes long-term investment into conversion of electric and diesel/petrol powered irrigation pumps to solar powered ones.*

### INTRODUCTION

The Ghana Irrigation Development Authority (GIDA) is a public sector organization established to promote agricultural growth through the provision of irrigation infrastructure and other Agricultural Water Management (AWM) techniques. The inception of irrigated agriculture in Ghana dates back to the late 1890s at Anloga in the Volta Region and Bawku in Upper East Region but formal irrigation started in the early 1960s. The present day GIDA, started as the

Land Planning and Soil Conservation Unit (LPSCU) of the Ministry of Agriculture in the early 1960s. Attention at the time was focused more on sustainable land use particularly, through the adoption of soil and water conservation best practices which helped to sustain farm productivity and thereby enhanced rural livelihood options for the Ghanaian farmer (Glitse et al., 2017).

In 1977, the then government realized the need to establish a national institution capable of mobilizing funds to undertake irrigation infrastructural development to sustain agriculture modernization drive and enacted the Irrigation Development Authority Decree, 1977 (SMCD 85) to outdoor GIDA as an autonomous entity. Since its establishment, GIDA has primarily been responsible for carrying out feasibility studies and the development of irrigation projects, technology transfer to consumers of irrigation services and in the management and maintenance of irrigation systems. In addition, GIDA undertakes minor services in civil engineering, water management, construction supervision, stock water and aquaculture services to both public and private sectors at marginal cost. Apart from SMCD 85 of 1977, the activities of GIDA are guided by Legislative Instrument (LI) 1350 of 1987 which provided for the regulation and management of public irrigation schemes and amended to LI 1995 of 2011 and LI 2230 of 2016 to regulate private investments in public irrigation, promote establishment and regulation of Water Users Associations (WUAs) nationwide (GIDA, 2016a).

In Ghana, irrigated agriculture is categorized into informal or smallholder irrigation, formal irrigation, and large scale commercial irrigation. Smallholder or small scale irrigation is practised by an individual who cultivates an area of up to about 0.5 ha or more by using simple infrastructure for water storage, conveyance and distribution provided from farmer's own resources. This form of irrigation is characterized by relatively small investment by farmers, dominated by manual fetching of water with buckets or watering cans with few lifting water by pumping. Traditional and community initiated schemes fall under this category which comprises irrigators in the south-eastern coastline of Ghana, groundwater irrigation near Bawku, irrigators in inland valley and along dams and dugouts in the northern part of the country as well as irrigated urban and peri-urban agriculture (GIDA, 2012).

Rural electrification programme embarked upon by various governments has played a critical role in the spread of small scale irrigation in the country. Presently, it is estimated that small scale irrigation covers an area of 189,000 hectares which amounts to 85.52 % of the total area under irrigation (GIDA,

2016b). Though the concept of small scale irrigation by definition is largely associated with informal irrigation in Ghana, a lot of formal irrigation schemes have been developed along the same line. GIDA classifies small-scale schemes with areas up to 500ha, medium-scale schemes are between 500ha and 1,000ha and large-scale schemes are larger than 1,000ha (GIDA, 2012). However, small scale irrigation either under informal or formal category are operated in similar manner and face common challenges as well as prospects.

Small-scale irrigation covers the largest area and generates employment for a large number of people in the irrigation value chain, thus contributing to the improvement of livelihoods of farmers in the country. In spite of the contributions small scale irrigation makes to the economy and livelihood of farmers, there is paucity of information on challenges and prospects in the sub-sector. The information gap leaves policy makers and implementers, academia and other relevant players to ponder over the following questions:

- i. What are the challenges confronting small scale irrigation in Ghana?
- ii. What are the prospects of small scale irrigation development in the country?

The main objective of this paper therefore is to highlight small scale irrigation in Ghana with specific focus on challenges and prospects in order to bridge the information gap. This is important because the bulk of irrigated agriculture is carried out by small scale irrigators. This will draw attention not only to small scale irrigation but the entire irrigation sub-sector in the country for much needed discourse to attract solutions to the challenges from major stakeholders. As flagship programmes such as "One Village One Dam" agriculture development agenda of Government are implemented, this study will bring the challenges facing small scale irrigation to the limelight to ensure that the programme is dovetailed into small scale irrigation for holistic outcomes.

## **MATERIALS AND METHODS**

Ghana is situated in West Africa and lies between latitude 4° 30' North and 11°30' North and longitude 1° 12' East and longitude 3° 15' West. The Greenwich

Meridian Line passes through the country, specifically through the industrial city of Tema. Ghana is bordered to the West by Cote d'Ivoire, North by Burkina Faso, to the East by Togo and to the South by Gulf of Guinea. Accra is the capital city while Tema and Takoradi are the main seaports serving the landlocked countries of Burkina Faso, Chad and Niger. The country has 10 administrative regions comprising Greater Accra, Central, Western, Eastern, Volta, Ashanti, Brong Ahafo, Northern, Upper East and Upper West Regions. Ghana's population grew from 24.5 million recorded during the 2010 Population and Housing Census to an estimated 29.6 million in March, 2018, an estimated 2.5% annual growth rate. It has a total area of 23.88 million hectares out of which irrigation potential approximates 1.9 million hectares. Small scale irrigation is practised across all the three zones: Northern and Southern Zones and Middle Belt. The division of the country into these zones is informed by the common environmental and climatic factors experienced in these zones. The northern zone which covers Northern, Upper East and Upper West Regions is characterized by savannah vegetation with uni-modal rainfall spanning June to October and a long dry season between November and May. The average annual rainfall of 1,000 mm recorded in this is relatively low and only able to support a single crop in a year. However, the construction of irrigation infrastructure permits a second crop to a limited degree. Interestingly, the northern zone has the highest number of dams and dugouts classified into small scale irrigation in Ghana. The main challenge is that most of the dams have areas exposed to high temperatures which contribute to evaporation of water in the dams, resulting in the drying up of most of these dams before the raining season begins and limiting their use for cropping. The middle belt is made up of vegetation type that ranges from transitional zone to forest and covers Brong Ahafo, Ashanti, Western, Eastern and parts of Volta Regions. The middle belt enjoys bimodal rainfall with a mean annual rainfall ranging from 1,400 to over 2,000mm. Though this region largely experiences bimodal rainfall, dry spells sometimes occur within the two raining seasons. Thus crops will require supplementary irrigation during dry spells to encourage optimal performance. The coastal zone stretches from Central Region to Greater Accra and

southern part of Volta Region. The coastal belt also has uni-modal rainfall averaging about 600mm per annum. Sustained all-year-round crop production can only be carried out in this region under irrigation as annual rainfall is insufficient to support crop production.

The key source of data for this study was secondary data which were obtained mainly by reviewing published reports, policy document, articles, online sources and official web sites of relevant state and international institutions. These institutions include the Ghana Irrigation Development Authority, Ministry of Food and Agriculture and United Nations Framework Convention on Climate Change among others.

## **RESULTS AND DISCUSSIONS**

### **Irrigation and Climate Change and Variability**

Increased temperatures associated with climate change are likely to cause reduced crop yields in countries lying in the tropics and result in high incidence of famine (UNFCCC, 2007). In our part of the world, changes in climatic conditions result in risks of extreme events including droughts, floods, pests and diseases, and other adverse impacts. Farmers are bearing the brunt of climate change and variabilities which pose major threat to their livelihoods. Increased incidence of pests and diseases leads to high cost of production. Apart from reduction in yield, droughts also account for crop failures (MoFA and FAO, 2017). However, under these conditions, irrigation comes in handy, serving as insurance against total or partial crop failure and permitting increased all-year-round crop production, thus improving farm incomes and employment opportunities. It also allows higher intensification, crop diversification and makes commercialization of agricultural activities possible. Thus, irrigation improves resilience of small scale irrigators to climate change and climate variabilities (Glitse et al., 2016). In the specific case of northern Ghana, droughts occasioned by climate change resulted in the drying of a number of dams specifically in the Upper East Region of Ghana in 2014/2015 cropping calendar which led to adverse impacts on the livelihoods of farmers (GIDA, 2016c). This assertion is consistent with Live Science (2009) which reported the drying of

Colorado River due to global warming. Moreover, the rate of evaporation of open water bodies including dams and dugouts is high in the long dry season spanning November to May. The long dry season is followed by heavy rainfall between June and October, often resulting in floods which affect cropping activities. A number of technologies including Bhungroo are relied upon to overcome these challenges. Bhungroo technology can be employed to save the situation by storing floodwater underground for dry season irrigation, permitting all-year-round cropping and thus guaranteeing food security (Glitse et al., 2016).

### Challenges Facing Small Scale Irrigation in Ghana

A number of challenges ranging from human to environmental and institutional affect small scale irrigation development in Ghana. These factors are discussed in the following sub-sections.

**High Cost of Energy:** Twenty six (26) Small Scale Irrigation Development Project (SSIDP) and eight (8) Small Farms Irrigation Projects (SFIP) were developed to give a total of 34 small scale irrigation schemes by GIDA. At the moment, 26 of these schemes use electric or diesel/petrol pumps to lift

water for irrigation while 8 depend on gravity systems. Additionally, majority of smallholder or informal irrigators employ pumps to lift water for cropping. However, the prevailing electricity tariff system in Ghana has rendered pump irrigation cost-ineffective and therefore unattractive due to maximum demand/multiplier factor tariff imposed on pump equipment. The option to use petrol/diesel pumps is expensive and fraught with other challenges including the relatively high price of the fuel, the complex nature of the internal combustion engines and the consequent frequent need for repairs and replacement of parts. Presently, fuel prices are reviewed very often and this does not help matters. These factors have created a huge barrier to the economic viability of small scale irrigation schemes that are not fed by gravity, thereby creating a major hurdle to their development (GIDA, 2016a).

A comparison of electricity tariff paid by irrigators in Ghana with those of selected countries in Africa shows that electric pump irrigation farmers in Ghana pay tariffs that are over 100% above that paid by farmers in Zimbabwe which is the second highest in the list of selected countries and over 400% that paid by farmers in Egypt which country has the lowest tariff (Fig. 1).

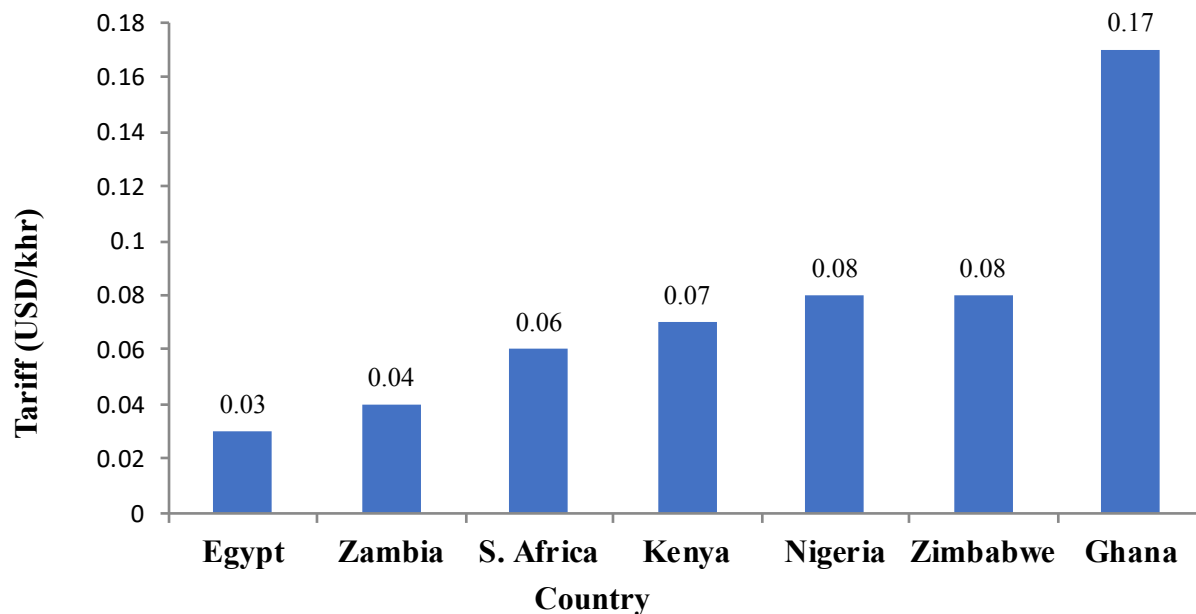


Figure 1: Comparison of Electricity Tariff per kilowatt hour Paid by Irrigators in Selected African Countries (2014). Source: (Statistical Portal, 2016).

The Maximum demand/multiplier factor component of the tariff places an unbearable burden on irrigation farmers who use electric pumps. Power supply to the schemes is sometimes disconnected in the middle of the cropping season when farmers fall behind in the payment of electricity charges to the Electricity Company of Ghana. This results in wilting of crops and eventually brings about loss of income. It also leads to the shutting down of a number of schemes whose source of energy is electricity, the most recent being Dawhenya and Subinja Irrigation Schemes. High cost of energy thus, undermines efforts of smallholder irrigators to adapt to climate change and variability.

**Poor Access to Land:** Irrigation development and for that matter small scale irrigation is constrained by weak legal framework, institutional structures and the policy environment within which land administration takes place. Land ownership particularly in the customary sector is challenged with indeterminate boundaries of land due to unreliable and inaccurate maps. In Ghana, about 80% of lands are owned by stools, families and traditional authorities and 20% by the state. Within the 80%, the boundaries are not well known. This is corroborated by the findings of Appiah (2012) in a research conducted on urban land management in Ghana who indicated that the land administration system is made up of poor maps. Additionally, there exist between and within stools, families and other land-owning groups conflicts of interests due to inadequate security of tenure making it difficult to use land as economic asset and collateral security in the country (GIDA, 2016e). This assertion is supported by the findings of Alhassan (2006) who reported that one serious land problem that results from population growth is insecurity of tenure.

There are instances where Government compulsorily acquired large tracts of land for agricultural and other development purposes without paying compensation to the landowners and this created much tension in these communities. In the instances of vested lands, the state takes over the legal interest of traditional authorities of such lands and allocates them without adequately consulting the landowners and creating further problems in the communities.

There are issues of poor record keeping both at the state and customary levels but more widespread at the customary level. For instance, a chief sells land to an individual and because records are not kept or are improperly kept, the same parcel of land is sold to another person. This finding is consistent with that of Sittie (2006) that the existing land administration system in Ghana is made up of poor records. All these issues have summed up to create insecurity, tension and difficulty in accessing land by investors (GIDA, 2016e) and go to adversely impact small scale irrigation development in the country.

The constitution vests all customary and stool lands in the stools and though customary law takes precedence over other laws in dealing with land, both customary and state laws operate at the same time. This leads to legal pluralism. There are issues of institutional pluralism where several institutions are found dealing with land. For instance, we have Town and Country Planning Department, Land Valuation Board and Lands Commission dealing with land (GIDA, 2016e).

**Encroachment:** Regardless of all measures put in place to secure irrigation lands by either outright payment of compensation to landowners and Chiefs in cash or in kind or cash payment at the end of each season, there is increasing incidence of encroachment by especially real estate developers on a number of small scale irrigation schemes including Akurobi, Adiembra and Asantekwaa with impunity. Moreover, Land Commission's reluctance to grant GIDA lease to land acquired with outright payment of compensation leaves these lands unprotected and easily encroached. Economic trees planted along the borders of acquired lands by GIDA to ward off intruders have been chopped down and periodic patrols by military personnel were found to be expensive and unsustainable (GIDA, 2016a). On some of the schemes such as Akurobi, a fast rate of land-use change is taking place where irrigation lands are being converted to real-estates due to encroachment which is in agreement with Allen et al. (2014) who found out in their study on land and planning for urban agriculture in Accra that national irrigation schemes are threatened by encroachment. Incidence of estate development is a major impediment to the development of small irrigation in

the country. However, the amendment of Irrigation Development Act is expected to give legal backing and power to GIDA to exercise absolute control over public irrigation lands.

**Illegal Mining Activities:** Illegal mining activities pose a major threat to small scale irrigation development in Ghana. Uncontrolled mining activities destroy irrigation infrastructure, pollute water resources for irrigation and impact negatively on irrigation lands. Pollution of water for agriculture is in conformity with Poku (2016) who indicated that illegal mining pollutes water bodies in communities. In many instances, Metropolitan, Municipal and District Assemblies (MMDAs) and Lands Commission offices in these areas issue permits to people who prospect for minerals on irrigation scheme lands. Reports made to the police have not helped much since they are unable to mount 24-hour surveillance and the miners are able to work at night if necessary to avoid arrest. Illegal mining undermines small scale irrigation development in Ghana.

**Lack of Technological Know-How:** Development of irrigation infrastructure is a specialized field which requires specific knowledge to accomplish. However, majority of local contractors have inadequate requisite knowledge to construct irrigation infrastructure to meet international standards. This affects the life span of irrigation infrastructure and serves as impediment to the development of small scale irrigation. The assertion is consistent with Kamunidia (2016) who found out that low level of technology affects irrigation development in Kenya.

**High Cost of Inputs:** Cost of producing irrigated crops is high because agricultural inputs are expensive to acquire. Apart from fertilizers which have long been subsidized, all other inputs required for production are expensive thus leading to high cost of production. In an attempt to cut down on the cost of production, some irrigation farmers do not apply the full dose of inputs which may lead to lower yields. Until 2017 when government introduced “Planting for Food and Jobs Programme” which expanded the subsidy programme to include seeds

of some selected crops, all other inputs apart from fertilizers were acquired at full cost. This minimizes profit margins of farmers and ties in with the findings of Taylor and Koo (2008) who indicated that increases in cost of inputs reduces net farm income. Acquisition of inputs without subsidy means price of farmers’ produce will be high and cannot compete with imported products. Faced with climate variability, high cost of inputs does not favour small scale irrigation development in Ghana.

**Inadequate Budgetary Allocation:** The irrigation sub-sector in general receives inadequate and frequently delayed government budgetary allocation to fill the financing gap caused by low Irrigation Service Charge (ISC) recovery from farmers. Inadequate budgetary allocation makes it difficult to carry out operations and maintenance of irrigation schemes nationwide. In the same vein, extension of irrigation infrastructure to more arid areas where irrigation is urgently needed is slow due to inadequate budgetary allocation by Government. The assertion that inadequate funds are allocated to carry out operations and maintenance is consistent with Akroyd and Smith (2007) and Namara *et al.* (2011) who alluded to the fact that insufficient funds are allocated to operations and maintenance of irrigation schemes.

**Inadequate Support Services:** Another factor affecting small scale irrigation development is unavailability of equipment. Agricultural production in general is time-bound and irrigated production much more so. However, equipment for land preparation, planting, weed control and harvesting are not readily available. This delays performance of specific activities and operations. Currently, farmers have to manually carry out most of these activities which may lead to delays. When harvesting of crops for instance is delayed, quality of produce may be compromised. This retards growth of small scale commercial irrigation in the country. Inadequate storage infrastructure affects quality of harvested produce which could adversely impact marketability, price of produce and farmers’ profit margins in the end. Like service and industrial sectors of the economy, agriculture thrives on credit for growth. However, access to credit for agriculture is difficult

and often cumbersome to come by because of high level of risk associated with agriculture. Though irrigation related-risk is minimal compared with rain-fed agriculture, both groups are often lumped together. Moreover, the deliberate attempts and failure by some irrigators to value the business-oriented nature of irrigated agriculture and their resultant lukewarm attitude in paying back loans and bills granted them by service providers to facilitate production of crops is a major setback for the sub-sector. This confirms the findings of Ngigi (2011) who indicated that inadequate access to credit slowed down development of smallholder irrigation in Kenya.

### **Prospects of Small Scale Irrigation in Ghana**

Irrigation development is a multifaceted activity which cannot be entirely carried out by a single set of professionals. The processes involved in acquisition of land, development of infrastructure for irrigation, cropping and marketing are specialized fields and best carried out by trained professionals. Moreover, a number of stakeholders ranging from Government (central and local) to relevant ministries, those in water and land resources sectors and Development Partners play important roles that are necessary for the development of small scale irrigation in the country. These specialized roles put together and collaborations GIDA has with other private and public sector institutions present a bright future for small scale irrigation as discussed in the subsequent sub-sections.

**Multi-disciplinary Professional Staff:** A major factor affecting both formal and informal irrigation development is the existence of a core of multi-disciplinary professional staff made up of civil engineers, agricultural engineers, geodetic engineers, quantity surveyors, agronomists, agricultural economists and sociologists who are involved in conducting feasibility studies of projects, design and construction of dams, tube wells and fish pond and project management. The professional staff have been taken through both local and international training programmes to equip them with new set of skills mix to match up with additional responsibilities that come as a result of restructuring and modernization programme being implemented by

GIDA. However, these professionals do not enjoy adequate representation on all the schemes and the regions throughout the country. GIDA is set to recruit staff, train and post them to the zonal, regional and scheme offices to help in irrigation development throughout the country.

### **Government Commitment to Irrigation Development:**

Small scale irrigation development in Ghana has a bright future owing to government commitment to providing water in as many communities as possible to speed up agricultural-led development through the construction of irrigation infrastructure, thus facilitating all-year-round commercial agriculture production. The current state of agriculture in the Savannah Zones of the country, impacted by dwindling rainfall which is occasioned by climate change and variability, makes it imperative to provide irrigation infrastructure for the inhabitants in these areas. Government of Ghana intends to implement its flagship programme, “One Village One Dam” agriculture development agenda which is expected to improve farmers’ levels of income and cause return migration to the rural areas that have witnessed massive migration in recent times to urban areas in search of non-existent employment opportunities.

### **Existence of National Irrigation Policy:**

The National Irrigation Policy, Strategies and Regulatory Measures recognizes the role of small scale irrigation in the development of the sub-sector. The Policy takes cognisance of the fact that it is easier to manage small scale irrigation by beneficiary farmers with minimum training. It also identifies with the five business lines along which irrigation is to be developed and places emphasis on community and individually-managed small scale schemes. Faced with intensifying climate variability, the irrigation policy guides and directs irrigation development and expansion within the country to promote reliable and sustainable food production and support food security which assertion aligns with Tanzania’s National Irrigation Policy (Ministry of Water and Irrigation, 2009).

### **Existence of Irrigation Development and Training Centres:**

The Ghana Irrigation Development

Authority boasts of an irrigation development centre on Ashaiman Irrigation Scheme where adaptive research is carried out on irrigated crop production. Moreover, a state-of-the-art training facility with dormitory as well as greenhouse training facilities has been constructed on Dawhenya Irrigation Scheme. GIDA also has a training centre near Burma Camp in Accra where staff training is organized. These facilities are used for training staff and farmers including small scale irrigators as well as graduate youth interested in taking up agriculture as full time business. GIDA recognizes the importance of training particularly of farmers on growth and irrigation-led development on food security and has therefore made it an integral part of its programmes. This is in harmony with FAO and SAFR (2000) who identified farmer training as one of the important factors for smallholder irrigation development in Zimbabwe.

To improve the technological know-how of local contractors, the Authority is collaborating with Development Partners by developing and rolling out training programmes for contractors involved in development of infrastructure in its state-of-the-art training centre on Dawhenya Scheme. In the near future, the Authority will make it mandatory for contractors to have certificates of proficiency issued by GIDA before bidding for contracts.

**Conversion of Grid/Petrol/Diesel Powered Pumps to Solar Powered Ones:** One of the cardinal reasons why most of the small scale schemes are currently out of production is high cost of energy to power irrigation pumps. It is worth nothing that in the interim, GIDA is engaging government to provide concessionary tariff to irrigation farmers while efforts are being made to transform all electric or diesel/petrol powered irrigation pumps to solar powered ones in the near future. Pilot studies on use of solar energy to power irrigation pumps have been concluded on Aveyime Irrigation Scheme and ready for out-scaling. As part of a deal with Ghana Agricultural Sector Investment Programme, solar energy will be extended to small scale irrigators in Keta District in the Volta Region. This is expected to improve irrigation activities of small scale irrigators in the area. Climate change and variability increase the risk level of people who depend entirely on

agriculture for their livelihoods. However, the development of more irrigation schemes in the future will necessarily have to rely on pumps to lift water since the approximately 88% untapped irrigation potential of the country will only lend themselves to the use of pumps to deliver water (GIDA, 2016a). Since using grid and diesel pumps is cost ineffective and unattractive, solar energy can be relied upon to turn small scale irrigation around. This assertion agrees with the findings of Roblin (2016) who suggested that solar-powered systems are tapped from free source of energy thus, “after the amortization period, there are no longer operating costs (only the maintenance costs must be considered). Therefore, solar pumps turn out to be a viable long term investment.”

**Establishment of Zonal Offices in all Agro-Ecological Zones:** By their nature, small scale irrigation schemes are dotted around the entire country and with the change in mandate of GIDA, the services of staff will be indispensable. GIDA has therefore, established three zonal offices to be filled with the full complement of staff in Tamale (Northern Savannah), Techiman (Middle Belt) and Accra (Coastal Zone) to serve as rapid response units to issues on all schemes. The zonal offices are serviced by specialists in engineering, environmental management, social aspects, agronomy, contracts management and scheme management who provide technical backstopping services to all public irrigation schemes and private irrigation practitioners within their respective zones. In addition, regional offices are established at Ho, Cape Coast, Accra, Bolgatanga and Wa with skeletal staff to manage the socio-political liaison activities related to agriculture water management and irrigation in the regions. The idea behind the establishment of zonal and regional offices is to bring technical services closer to both public and private irrigators.

**Donor Support:** GIDA has established good and cordial relationship with Development Partners who provide financial and technical support in construction of small scale irrigation infrastructure that meets their objectives. GIDA enjoys support from partners such as Food and Agricultural Organization (FAO), World Food Programme



(WFP), Japan International Cooperation Agency (JICA) and Korea International Cooperation Agency (KOICA) among others. This collaboration is expected to continue to ensure that more small scale irrigators have the opportunity to carry out all-year-round crop production as climate variability intensifies and makes agriculture production extremely difficult.

**Establishment of Land Allocation Committee:** The Legislative Instrument (LI) 1350 of 1977 requires that Land Allocation Committees (LACs) be established on each scheme. This committee facilitates equitable allocation of land among interested farmers by ensuring that resident and serious farmers are allocated land. LAC ejects farmers who refuse to pay ISC or fail to use their land for the intended purpose. This will ensure high ISC recovery. LAC works in collaboration with the Disciplinary Committee which is also established on the schemes to ensure that feuds on each scheme is settled to foster congenial atmosphere for production of crops. The current arrangement on all public small scale schemes requires that all irrigators are put into Water Users Associations. This is to ensure that the benefits of group cohesiveness could be taken advantage of for delivery of irrigation services to the farmers.

**Availability of Water:** Ghana is endowed with an estimated 53.2 billion cubic metres of water per annum. This is made up of 30.3 billion cubic metres of water produced internally and 22.9 billion cubic metres per year of run-off from neighbouring countries. This provides a huge potential for abstraction of water from perennial sources such as rivers especially as only about 12% of the irrigable potential in Ghana has been tapped (GIDA, 2017).

**Public Private Partnership (PPP) Unit Establishment:** The Government has since 2009 established PPP Unit in Ministry of Finance with laws to protect private investments. GIDA realizing the significance of promoting small scale irrigation is at the advanced stages of establishing irrigation PPPs with the aim of undertaking major and minor irrigation investment projects which are designed to leverage private sector resources significantly by

structuring irrigation projects using PPP arrangements. This could be relied upon to promote small scale irrigation development in the country. The Ghana National Irrigation Policy has been reviewed to make provision for irrigation sector PPPs to give it the legal backing in its development.

**Tax Relief for Importation of Agricultural Machinery and Equipment:** Government has put in place a number of incentive tax packages including tax relief for importation of agricultural machinery and equipment. The aim is to ensure that cost of farm machinery and equipment are made affordable to all groups of farmers including small scale irrigators.

## CONCLUSIONS

Small scale irrigation in Ghana contributes significantly to the development of the economy by permitting all-year-round agricultural production, diversifying crop production and improving farmers' income levels. However, a number of challenges make it difficult for the full realization of these benefits. Against this background, the following recommendations are made to improve upon the fortunes of small scale irrigators in the presence of climate variability and change.

1. High cost of energy is identified as one of the main challenges faced by small scale irrigators in the country. It is therefore recommended that Government expedites action on the conversion of all electric and diesel/petrol powered pumps to solar powered pumps to curtail increasing cost of production.
2. Government is also requested to speed up action on amendment of Irrigation Development Authority Act which will give legal backing and power to GIDA to enable it exercise absolute control over public irrigation lands including those of small scale irrigation. The legal backing will enable the Authority to take assertive and decisive action against illegal miners and encroachers of irrigation lands thereby helping to tackle the threat of encroachment.
3. To deal decisively with the issue of illegal mining which threatens existence of irrigation

schemes nationwide, the Ministry of Lands and Forestry should be supported in their “fight” against illegal mining by the security agencies, civil society organizations and individuals to bring the threat to an end.

4. To overcome the challenge of lack of equipment, the law that established Water Users Associations must be enforced. This is expected to result in viable groups that will enable them pool resources together to access subsidized farm machinery offered by Government of Ghana to farmers.
5. On the issue of lack of credit for irrigated agriculture, irrigation farmers are recommended to access services offered by anchor/nucleus farmers. Currently, a number of anchor farmers such as WIENCO-COPA CONNECT and GADCO Limited are promoting some form of PPPs where the anchor farmers advance input credit to smallholder irrigators, train them to produce crops to specification by offering extension services to the farmers and buy farmers produce. Partnership of this nature is symbiotic in the sense that farmers get inputs for their farms while anchor farmers are able to buy the required amounts of produce to meet contracts either locally or internationally.

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