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RESEARCH ARTICLE

Mainstreaming climate change adaptation into pro-poor development initiatives: evidence from local economic development programmes in Ghana

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ABSTRACT

Climate change remains a serious threat to climate sensitive pro-poor development interventions in the Pru District of Ghana. This study examined how climate change impacts on Local Economic Development (LED) interventions, the extent to which climate change adaptation (CCA) initiatives are integrated into LED and the challenges associated with the mainstreaming process. Qualitative research design and purposive sampling was used to collect data from 28 respondents at the Pru District Assembly with an interview guide. The results show that climate change adversely affects the following LED programmes; beekeeping, micro-credit for agricultural development programme, and fishing net and outboard motor programmes. The findings further indicate that climate-smart Agriculture, aquaculture (Fish Cage Culture) and Sustainable natural resource utilization and management the CCA initiatives mainstreamed into pro-poor LED in the Pru District to reduce the inevitable impacts of climate change. The study identified multifaceted challenges militating against CCA mainstreaming in the District to include inadequate resources for CCA, inactive stakeholder and institutional collaboration, and lack of continuity of CCA programmes. This paper recommends strong government support for CCA programmes, commitment of adequate resources and effective stakeholder and institutional collaboration. The paper concludes that effective integration of CCA into pro-poor LED is a panacea to achieving sustainable local development.

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Local economic development; climate change adaptation; pro-poor development resilience

1. Introduction

Over the past twenty years, Local Economic Development (LED) programmes in Ghana have been progressively prescribed by development actors as a supplement to the conventional top-down development approach Mensah et al. (2013a). Worldwide, LED has been accorded credence and recommended as one of the surest strategies for accelerating the efforts to tackle local development deficits at the local level (Rogerson, 2018). It is also recognized that climate change is affecting LED in developing countries. There is therefore an urgent need for local authorities to explore climate change adaptation (CCA) options and mainstream adaptation to reduce possible vulnerabilities and improve local development (Musah-Surugu et al., 2019). Mensah et al. (2013b, 2b) postulated that 'Governments of Africa have identified LED as a key priority to enhance development and governance at the local level'. Khan (2015) has also emphasized the rising importance of LED across Africa indicates that the practice has become an extremely fashionable subject within the quarters of international development cooperation programmes prescribed for African states. According to Oduro-Ofori (2011), the overall rationale for pursuing LED is to mobilize the local economic potential by bringing innovation to all its growth dimensions which range from infrastructure to local small and medium-scale enterprises (SMEs) and the capacity to attract foreign direct investment, fostering territorial competitiveness, strengthening local institutions, better management of the development process and internalizing local resources. It is worth mentioning that LED strategies have been persistently deployed in the battle against the conditions of being poor, to promote social inclusion and improve ecological well-being. These conditions reposition social and economic strategies along bottom-up development approaches (Khan, 2015). LED 'offers a means to counteract or take advantage of the forces of globalisation by maximising local potentials' (Lawrence, 2013).

Current studies on LED in Africa have mostly concentrated on appraising the implementation of LED, its challenges, stakeholder involvement and the role of national governments (Rogerson, 2010; Rogerson, 2011). The principal policy debate and research on LED in Ghana have mainly centred on policy implementation, legislative and institutional perspectives, challenges of LED, multiple actors and stakeholders' involvement, the role of local government and so on (Akudugu, 2013b; Akudugu, 2018; Mensah et al., 2013a; Mensah et al., 2013b; Oduro-Ofori, 2011). Notwithstanding these investigations, climate change, which is one of the major problems confronting LED in Ghana and Africa, has not been adequately researched. Climate change certainly affects LED, especially in climate sensitive sectors. The agricultural, forestry and fisheries sectors in Ghana are critical areas that are used to propel LED programmes. These sectors are sensitive and responsive to climate change threats like floods, drought,

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rising temperature, wildfire, and erratic rainfall (Asiedu et al., 2019). For example, Asante and Amuakwa-Mensah (2015) observed that rising water temperature has increased fish stock losses and fish mortality, reduced fish yield, damaged ponds, and increased operating costs. Asiedu et al. (2019) indicated that events such as flooding carry fish stocks trapped in fishing nets away and also damage the harvesting systems thereby rendering fisherfolk jobless and worsening their poverty situation. Again, recent studies show that climate change is affecting the yield of cassava with production losses up to 3% in 2020 and projected to increase to 13.5% in 2050, and 53% in 2080 (Sagoe, 2006; Van Oort & Zwart, 2018). Maize yield is estimated to decline by about 15% by 2050 in all regions in Ghana**.** It is in this regard that this paper examines climate change impacts on LED interventions in the Pru District as well as the mainstreaming of CCA into LED initiatives and how best to fix the associated challenges.

2. Theoretical literature

2.1. Mainstreaming climate change adaptation into local economic development (LED)

As has already been mentioned, major sectors of Ghana's economy are considered climate sensitive because they are predominantly natural resource based and extremely exposed to climate change risks (Owusu & Waylen, 2013). The fundamental stressors of climate change such as floods, drought, and sea erosion are indicative of the prevalence of climate change hazards in Ghana. The success of LED in Ghana is dependent on the mobilization of climate sensitive sectors such as agriculture, water resources, fish farming and infrastructure. In order to effectively management climate change impacts through prevention, mitigation and adaptation measures in the country, it is important that climate change is integrated in the design of LED policies and programmes (Dumenu & Obeng, 2016). To illustrate the importance of this view, the paper discusses agriculture, fisheries and aquaculture which are principal sectors of rural economies in Ghana attracting significant LED initiatives.

Climate change mainstreaming adaptation into development is generally implies integrating climate change concerns into existing programmes and decision making choices (Klein et al., 2007). In the view of Oates et al. (2011), it is the incorporation of critical climate change issues into structures of decision making that influence nationwide and sectoral growth strategies, policies, investments, and activities. According to Rayner and Berkhout (2012) mainstreaming Climate Change Adaptation(CCA) into development activities is taking decision on the basis of the best available information regarding data on climate and potential implication of climate change for different sectors, as well as the potential adaptation options.

The integration of CCA into local climate sensitive resources has proven to be capable of strengthening livelihoods and creating employment for local people (Alhassan & Hadwen, 2017). To integrate CCA in national development planning requires a wide range stakeholder involvement and coordination from national government ministries to sector agencies, local governments and civil society. The involvement of stakeholder helps to ensure that activities are informed by practical knowledge and experience from the grass root. In order to use stakeholders effectively to ensure success of adaptation mainstreaming, a coordinated action of local departments and agencies are required. The absence of inter-coordinated efforts hinders efforts to minimize the risk associate with climate change threats (Parry & Taylor, 2012; UNDP-UNEP Poverty-Environment Facility, 2011). Rayner and Berkhout (2012) also added that when climate change adaptation is integrated into existing decision making and programmes then mainstreaming has been carried out. Adaptation should be facilitated in consistency with development objectives and aligned with existing governance structures. Monitoring and evaluating the processes of CCA mainstreaming helps policy makers to determine if the desired outcomes are being achieved. Evaluation of the process also enables the timely adjustment of policies, when circumstances require so. In this way, the integration policies can be adaptive in themselves (CARE, 2009).

According to the Local Governance Act, 2016 (Act, 936), the District Assemblies are responsible for promoting Local Economic Development (LED) in Ghana. This implies that District Assemblies act as the lead agencies in coordinating LED activities in the Districts (Akudugu, 2013b). For each District Assembly, the design and implementation of LED activities is mainly the responsibility of the District Planning and Coordinating Unit (DPCU) and the Business Advisory Centre. However, LED programmes can also be designed by other decentralized agencies like the District Department of Agriculture with the District Assembly's support (Mensah et al., 2013a). The formulation and implementation of LED activities is expected to be participatory with broad stakeholder and institutional involvement (Akudugu & Laube, 2013a). Unfortunately, broad engagement is usually ineffective, and this tends to expose local development programmes to climate change threats. Alhassan and Hadwen (2017) posited that the vulnerability of local development programmes in Ghana to climate change threats can be attributed to the non-consideration of CCA elements in the programme formulation and implementation processes. Asiedu et al. (2019) revealed that even though local actors are privy to the impact of climate change threats to LED activities, they tend to ignore these threats in the design and implementation of CAA programmes, thereby making them vulnerable and unsuccessful. Asante and Amuakwa-Mensah (2015) and Asiedu et al. (2019) added that the recent calls by scholars and international development organizations for integration of climate change into LED programmes is gaining grounds although the results are mixed with a number of successes and failures (Table 1).

Different structures and approaches have been put in place in Ghana over the years to manage LED initiatives at the grassroots level. But despite the strategic importance of mainstreaming climate change into LED, the obstacles constraining the processes are several. According to Alhassan and Hadwen (2017), the mainstreaming of climate change into local decision making is affected by (a) ineffective coordination and collaboration between the District Assemblies and the decentralized departments such as Department of Agriculture, Department of Fisheries; (b) inadequate information on the

Table 1. Typical examples of local economic development programmes.

Local economic development programmes	Source
Provision of Micro-credit facilities	Nel et al. (2002), Tarozzi et al. (2015)
Support to Small and Medium Scale Enterprises	Akudugu (2013b)
Provision of infrastructure to enhance trade	Mensah et al. (2013a), Cahill (2005)
Upgrading skills of Artisans	Rogerson and Rogerson (2010)
Agricultural development	Banchirigah and Hilson (2010), Mensah et al. (2013a)
Agro- processing	Offei-Aboagye (2009)
Subsidising agriculture & fishing inputs	Helmsing (2003), Cahill (2005), Kline and Moretti (2014)
Alternative livelihood schemes (bee keeping, Snail rearing, Grass cutter rearing)	Wilson (2008), Jeil et al. (2019),
Local tourism Development	Rogerson (2006), Rogerson (2012)

vulnerability of districts to climate change; (c) inadequate early warning systems; and (d) the trivializing of climate change issues. As a result, most interventions instituted to reduce the impact of climate change on LED are often poorly planned, implemented or communicated to stakeholders and sectors (Yeeles, 2018). There is often a lack of data on climate change related issues and interventions, especially the cost effectiveness of the various adaptation strategies (Dumenu & Obeng, 2016). Munck af Rosenschöld et al. (2014) also identified a number of obstacles that are likely to impede mainstreaming of CCA to include the difficulty to create the needed awareness and building knowledge. Organization of Economic Coorperation and Development (2009) and United Nations Development Programme (2011) also observed that climate change is a multifaceted subject heavily linked to development concerns, thus requiring huge resources to handle.

3. Methodology and study location

A qualitative research approach underpinned this study. Purposive sampling strategy was adopted to select respondents from the decentralized departments/agencies of the Pru District Assembly, Non-Governmental Organizations (NGOs) and the local media in the District. This approach is appropriate for the study because it draws together people's knowledge, experiences, priorities and contemporary understanding of a particular phenomenon (Yin, 2013). For assurance of reliability and validity of findings, this approach to investigation facilitated exploration of a phenomenon within its natural context using a variety of data sources. This study adopted purposively sampling techniques because its permitted the researchers to select respondents who possessed the requisite practical acknowledge, understanding, and experience on integrating climate change adaptation into local economic development in Pru district.

Nine (9) respondents were selected from decentralized public agencies in the district, including; District Coordinating Director(DCD), District Planning Officer(DPO), District Finance Officer(DFO), District Agriculture Officer (DAO), Business Advisory Center (BAC) Officer, District National Disaster Management Organisation (DNADMO), District Health Service Directorate (DHSD), District Fisheries Director (DFD) and an officer from the National Resources and Conservation Department (NRCD). The staff from the various department and agencies participate in critical LED decision-making and have in-depth understanding on the issues of climate change mainstreaming in the district. Other participants of the field study included three (3) respondents from a local radio station (Alive FM), Yapra Rural Bank and one Non-Governmental Organisation (NGO) – Mercy Project Initiative. These participants were selected because of their respective roles in local development and the implementation of Local Economic Development (LED) policies and strategies and the need to obtain comprehensive data for analysis and generating objective results and conclusions. For example, the Yapra Rural Bank financed a LED programme in the study location while the NGO Mercy Project Initiative was involved in the study because it had in-depth experience on rising water temperature on the livelihoods of fisher folks. The complexity and multidisciplinary nature of climate change require the involvement and these interviewees in order to obtain a comprehensive understanding and their actual experiences on local climate change impacts. In addition, sixteen (16) local citizens who are beneficiaries of LED interventions were purposively sampled. They included fishermen, fishmongers and smallholder farmers who have been experiencing the daily adverse impacts of climate change on their economic activities and livelihoods. In total, a sample size of twenty-eight (28) respondents provided information for the preparation of the paper. This number is considered appropriate for a qualitative case study design (Neuman, 2014). This number is also suitable because it involved the staff of all the appropriate departments as well as representatives of both public and private agencies in the Pru District.

Face-to-face interviews were conducted with the respondents to collect relevant information on Climate Change Adaptation mainstreaming into LED for analysis. The interviews were conducted in English and in the local languages of the study location (Nchumuru, Bono, Ewe, Konkomba). The interviews were audio-taped, translated and transcribed for analysis, interpretation and integration of the results in the findings of the desk research. The audiotapes were also supplemented by information gathered through physical observation. Verbatim accounts from the respondents were utilized to buttress the arguments generated by the participants. To enable clarity from the analysis of the collected information, the participants were coded as BENE 1, BENE 2, BENE 3, BENE 4 till the last respondent. The transcribed data was organized and reviewed thematically to respond to the research questions. Each objective of the paper was thematically presented in tables. Each table was sub-divided into five columns; (a) informant; (b) informants' responses; (c) agreement; (d) disagreement; and (e) emerging themes from the respondents' reactions. The individual themes were then examined and analysed qualitatively to determine which themes appeared most frequently, in what settings and their inter-relations. The tables allowed the deduction of responses for each emerging principal theme and pattern and which are

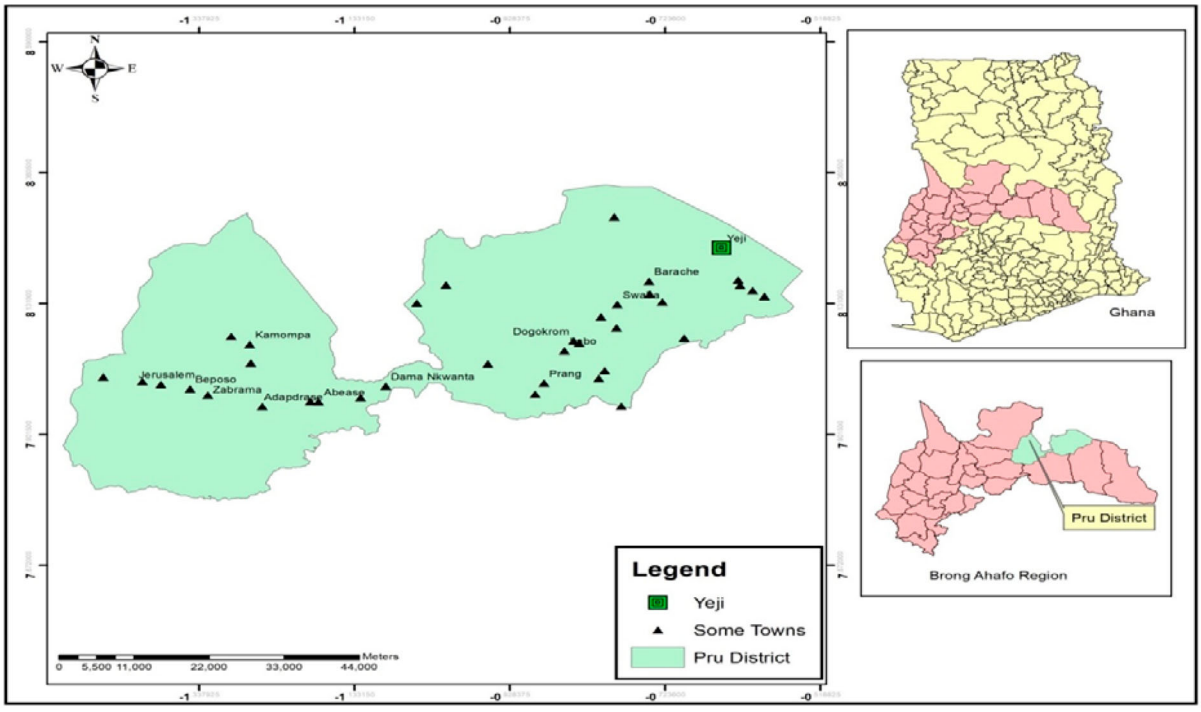

Figure 1. Location of Pru District in national and regional contexts.
Source: Pru District Assembly (2017).

then compared with those that emerged from the literature review.

The study was conducted in Pru District in Brong Ahafo Region of Ghana. It is located in the Transitional Ecological Zone (TEZ) of the country (see Figure 1). Although the Guinea Savannah Ecological Zone is known to be highly vulnerable to climate change threats, current studies indicate that TEZ is experiencing devastating climate change threats such as extreme heat waves, high winds, floods, drought, extreme variability of the rainfall pattern which has resulted poor agricultural performance and declining biodiversity (Codjoe et al., 2014). With the majority of the population's livelihoods and employment being dependent on climate change sensitive sectors like agriculture and fisheries, the efforts of local authorities and other stakeholders to stimulate LED have been seriously undermined. A total of 65.9% of the employed population is engaged in agricultural, forestry, and fishery. Generally, all the economic activities in the study location are vulnerable to climate change impacts (GSS, 2010). To manage these impacts, a number of CCA interventions (Adaptation of Agro-Ecosystems to Climate Change (AAESCC) and Improved Fish Smoking and Mangrove Restoration in Action) have been implemented in the district.

4. Results

The main objective of this study was to examine mainstreaming Climate Change Adaptation (CCA) into pro-poor development initiatives using LED programmes in Ghana and Pru District as the study setting. The analysis is centred on the impacts of climate change on LED programmes, mainstreaming CCA into LED and the associated challenges.

4.1. The effect of climate change on local economic development

This objective of the paper focused on analysing the impact of climate change on bee keeping, micro-credit for agriculture development programme, and fishing net and out board motor programme implemented in the Pru District. The magnitude of local climate change threats on pro-poor development interventions informed the mainstreaming of CCA strategies to safeguard the LED programmes. The results of how climate change affects the pro-poor development interventions in the Pru District are summarized in Table 2.

4.1.1. Bee keeping

The field study revealed that beekeeping was adopted as a pro-poor LED intervention to improve unemployment and income generation in local communities in Pru District Assembly. The beneficiaries of the intervention were drawn from the following local communities; Yeji, Abease, Kobre, Prang, and Parambo. The data analysis demonstrates that climate change threats such as rising temperature, bushfire, drought, and rainstorms affected the level of honey production in the Pru District and the bee-keeping LED programme. The results of the analysis indicate that climate change is thwarting the efforts of the Pru District Assembly to provide sustainable employment for the local people and reduce poverty.

Currently, the Pru District is experiencing an annual temperature rise between 0.1–0.3 degrees (Ghana Meteorological Agency, 2015). The District Agricultural Director indicated that severe drought and excessive temperature increase are being experienced in the district and this is resulting in the late flowering of plants. Bees largely depend on flower nectar as raw material for producing quality honey; the delay in the

Table 2. Effects of climate change on bee keeping.

Local economic development programme	Local climate change threats	Nature of climate change impacts on bee keeping	Beneficiaries / Officers responses
Bee Keeping	• High Temperature • Bushfire • Drought • Rainstorms	• Excessive temperature rise cause bees to flee the bee hive boxes resulting in low honey production. • Destruction of bee hive boxes by wildfire. • Low quality of flower nectar for bees as a results of late flowering due to poor precipitation. • Bee hive boxes placed under tree cover are destroyed by falling tree branches during rainstorms. • Reduction in the quantity of annual harvested honey between 23% and 45% in the district (Pru District Assembly, 2017). • Bee farmer's income levels decrease mainly because of these climate hazards.	The National Disaster Management Organization (NADMO) staff disclosed: *During the latter part of the year, normally early December, we record unprecedented numbers of bushfire disasters on farms across the district and a lot of bee farms have been burnt … The district has also been experiencing rising temperatures due to prolong drought and this has caused plants to undergo delay flowering and flower abortion. This means bees won't have enough nectar to produce honey for bee keepers to harvest.* One respondent opined thus: *I have lost a lot of beehive boxes from my bee farm which was mainly caused by bush fires during excessive drought. Delay in flowering, rainstorms, excessive temperatures are also factors affecting honey production. I am sometimes discouraged to continue the Bee-keeping business*. (BENE 12)

rainy season results in late plant flowering and this negatively affected honey production. In addition, because of the prolonged drought in the district, bushfires have become prevalent and an annual ritual and is thwarting efforts to improve the local economy. A lot of beekeepers have lost their beehive boxes because of bush fires and severe rainstorms. Consequently, honey production in the district and the income of beekeepers have significantly dwindled. Most bee-keepers are unable to properly feed their families and send their kids to school. The lessons of the impact of climate change on LED activities in Pru District can inform and guide similar actions in other districts in Ghana.

4.1.2. Micro-credit for agriculture development programme

Micro-credit programme for agricultural development was a collaborative pro-poor intervention implemented by Pru District and Yapra Rural Bank Limited to provide micro credit to rice and maize farmers. The objective of the programme was to boost local youth employment, increase farmer's income and improve their livelihoods. The results of the field data analysis show that climate change threats have severely impacted on the provision of micro-credit for poverty reduction in the Pru District (see Table 3). The micro-credit programme covered 124 and 112 rice and maize farmers respectively.

The findings of the field data analysis indicate that several hectares of farmlands were flooded, and farmers lost a significant part of their crop. Most of the farms were located close to waterlogged areas around the Pru River and the Volta Lake. The decision to site the farms closer to the water body was informed by the droughts the district experienced over the years. But this led to the flooding of the rice farms of the micro-credit scheme beneficiaries and their inability to repay their loans. The farmers would have been in a better position to repay their loans if they had enjoyed bountiful yields. The beneficiaries attributed their indebtedness to drought, floods and bushfires sparked by worsening climate conditions. The beneficiary farmers indicated that the interest on the loan was minimal with a flexible payment period, hence they could have repaid their loans with ease but for the yield losses

Table 3. Effects of climate change on micro-credit for poverty reduction programme.

Local economic development programme	Local climate change threats	Nature of climate change effects on micro-credit for poverty reduction	Responses of beneficiaries / Participants
Micro-credit for poverty reduction programme	• Floods • Bushfire	• Fifteen (15) hectares of rice farms have been flooded by the Pru River and the Volta Lake leading to loss of rice fields at Prang, Kobre Nsuano, Accra town, Brekente, and Yeji Kwayase. • Farmers lost the entire credit facility invested in the rice farms. • Farmers are unable to repay their loans. • Yapra Rural Bank and Pru District Assembly have suspended the intervention. • ushfires raged over 480 acres out of the over 600 acres of maize farms cultivated by beneficiaries of the micro-credit scheme.	A Yapra Rural Bank official explained the situation in these words: *We took a decision to support some farmers to go into rice cultivation as the Bank's policy to support rural farmers in the Pru District.W have been doing business with them for many years now. But I think the vagaries of the weather didn't permit the farmers to harvest any substantial crops as most of the farms were either swept away by floods or crops didn't do well because of drought. They are finding it hard to pay back their loans.* A micro-credit beneficiary confirmed thus; *I am a farmer and the bushfires are just too much. This year, I cultivated seven hectares of rice and what I harvested was not be even up to one bag; floods normally have been a challenge. This is why a lot of people don't want to go into farming, you will invest a lot of money and at the end of the year you will be in debt and you won't get anything*. (BENE 1)

Table 4. Effects of climate change on fishing nets and outboard motor programme.

Local economic development programme	Local climate change threats	Nature of climate change effects on fishing nets and outboard motor programme	Responses of beneficiaries and participants
Fishing Net and Outboard Motor Programme	• Floods • Drought	• Rise in temperature of the Pru River and Volta Lake results in the decline in fish production due to the movement of fish to deep cooler part of the lake where nets are unable to reach. • Heavy rains caused Pru River and Volta Lake to flood their banks into large grass fields causing fishes to move to these grassy areas thereby reducing the assemblage of fish in the main lake resulting in low fish catch. • The low fish catch reduces income of farmers and affects their capacity to pay for the subsidized fishing nets and outboard motors. • Farmers fail to repay the subsidized loans. • The programme was suspended because beneficiary fishermen were unable to repay their loans.	A fisherman explained his anxiety in thus: *Fishing activity is becoming a bad business. We hardly catch any fish to sell to meet our daily needs. And making matters worse, we owe the government for the fishing nets and the outboard motors supplied us at reduced prices. It seems there is no fish in the lake.* (BENE 8) The Department of Fisheries corroborated this by explaining that: *When there are regular floods, it becomes very difficult to catch fish since most of the fish in the lake feed on grasses, they move to grassy areas and this mostly accounts for the low fish catch fishermen experience. This has affected the ability of the fisher folk to repay the subsidized fishing nets and outboard motors we supplied them.*

they experienced because of the climate change impacts. The climate change impacts and the farmers' inability to repay their loans encouraged the Bank to withdraw its credit scheme for farmers in the district.

4.1.3. Fishing nets and outboard motor programme

The objective for initiating the fishing nets and outboard motor pro-poor LED intervention programme by the Pru District Assembly and Department of Fisheries was to boost the local fishing industry through increased fish production, poverty reduction, improved incomes and job creation. A total of 654 fishermen were supplied with subsidized outboard motors and fishing nets. Table 4 provides the results of climate change impacts on the fishing net and outboard motor programme.

The Fisheries Department of the Pru District indicated that prolonged droughts often reduce the level of the Volta Lake and cause an increase in water temperature. This situation is responsible for fish moving to deeper cooler parts of the lake and out of the reach of fishermen. Data form the Department of Fisheries also show that during heavy downpours, the Volta Lake and the Pru River overflow their banks and flood large grass fields that serve as feeding grounds for the fishes but are unsuitable for fish harvesting. The movement of fish to grassy feeding grounds reduce the available stock in the main lake as well as fishermen's harvest and incomes. The programme was halted because of poor performance.

4.2. Mainstreaming climate change adaptation into local economic development

Mainstreaming CCA into LED refers to the process of integrating climate change in development planning, budgeting as well as implementation and monitoring processes (UNEP, 2011). This paper examined the incorporation of climate change threats like rising temperature, floods, erratic rainfall, rainstorms, and wildfires into LED. The paper focused on the integration of agriculture, fisheries and aquaculture activities in the design and implementation of CCA strategies. Important elements considered included climate smart agriculture, fish cage culture and sustainable utilization of environmental resources. This approach aims to ensure the long-term sustainability of the investment in LED programmes in the Pru District whiles increasing the responsiveness of LED activities to current and future climate threats. The district wide performance appraisal conducted on climate change provided significant leads on climate risks on LED, climate change risks as well as adaptation and mitigation measures. The objective of the adaptation initiatives aim to reduce the susceptibility of LED activities to rising temperature, floods, erratic rainfall, rainstorms, and wildfires which are worsening in the district. Clearly, climate smart agriculture, aquaculture and sustainable natural resource management are appropriate CCA initiatives that should be mainstreamed into Pru District to guarantee the sustainability of LED results and outcomes.

4.2.1. Climate-smart agriculture (CSA)

The Pru District Assembly introduced climate-smart agriculture (CSA) as an intervention for minimizing the impacts of climate change on agricultural activities and the livelihoods of farmers. The Pru District Assembly, the Department of Agriculture and other stakeholders with financial assistance from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) jointly implemented a number of CSA interventions within the framework of Adaptation of Agro-Ecosystems to Climate Change (AAESCC). The objective is to reduce climate-related yield losses experienced by farmers in the district. The key factors that influenced this situation in Pru District included early onset of rains or delays in rainfall. To mitigate this challenge, farmers were introduced to improved maize varieties that are drought resistant and enjoy short maturity periods. This enabled the farmers to harvest their crops before the flooding period (July to September) and the intensive bushfires period between October and January every year. This has significantly reduced the incidence of flooding of farms and the destruction of crops by bushfires in the district. The implementation of agroforestry was also introduced as a strategy to control erosion during periods of heavy rains especially in communities like Kwayase, Kadue and Ajentruwaa. This intervention particularly aimed at equipping smallholder farmers threatened by adverse climate change

Table 5. Climate smart agriculture and its impact on farmer's livelihood.

Climate change adaptation programme	Climate-smart agriculture activities	Outcome of the *Climate-Smart Agriculture (CSA)*	Responses of beneficiaries and participants
Climate-Smart Agriculture (CSA)	Mobile Weather Alert Messaging; • Farmers at Kofi Basari and Kwayase were trained and equipped on how to access weather information via their mobile phones. Agroforestry; • Farmers plant trees and crops on the same land (e.g. Obaartampa maize inter-cropped with Crotalaria) Improved Maize Varieties • Farmers planted high yielding, short duration, drought resistant varieties of maize like Sanzal-sima, Wang-gata and Bihilifa • New drought and pest resistant maize varieties supplied to farmers	• Farmers at Kofi Basari and Kwayase plant the right crop varieties and at the right time. • Farmers recorded high yields of maize. • Inter-cropping helped to create permanent soil cover to protect against erosion during heavy rains. • Farmers' capacity has been strengthened to withstand local climatic conditions. • Increase in farmer's income and livelihoods.	The District Agriculture Office explained thus: *The farmers were trained on the types of crops and varieties of crops that they can plant to resist drought and provide good yields. Early and short duration crops like maize wang-gata and sanzal-sima were supplied to farmers. Our local farmers who were not getting anything because of drought are now growing maize varieties which take less than three months or 75–80 days to mature. The farmers are now getting high yields and are assured of increasing incomes which is a positive step to making the local economy better.* Another farmer disclosed the following: *My colleagues and I have experienced tremendous improvement in crop yields because of the new technologies we are using on our farms. We are able to minimize the effects of climate change on our farming activities compared to when we weren't introduced to these improved crop varieties and technologies. We harvest a lot and I have seen improvement in my income levels.* (BENE 5)

Table 6. Aquaculture and increased in fish stock.

Climate change adaptation programme	Aquaculture (fish cage culture) activities	Outcome of the aquaculture (fish cage culture)	Responses of beneficiaries and participants
Aquaculture (Fish Cage Culture)	Number of cages deployed; • Eighteen (18) fish cages were set up at Kajai, Jaklai and Brekente. • Each of the cages housed 90,000 fingerlings. • High temperature resistant and prolific fish species were introduced (Tilapiines, Chrysicthys, Cluipeidae, and Labeo) were stocked in the cages.	• This intervention has increased fish production in Pru District. • Fisher folks' income levels have increased significantly. • The adaptive capacity of local fisher folk to climate change threats has improved. • The economic activities of the people have been sustained. • The total fresh fish production stood at 72.33 mt which is an increase of 9.0% over the 2017 figure of 65.64 mt.	According to the Department of fisheries: *The main focus of the initiative over the medium-term is to shore up and accelerate fish production in the wake of climate change threats and to make the livelihoods of the local people sustainable.* A respondent disclosed the following: *I have four (4) fish cages on the Volta Lake and I can confidently state that my family is living well. My finances have improved. Even during the period of harvesting and processing of the fish for sale, I employ an additional twenty people and I pay them well. The introduction of the fish cage system has improved our lives.* (BENE 13)

impacts. The adoption of CSA activities is sustaining the livelihoods and income of farmers because it allows them to plant and harvest their crops on time. Table 5 provides a snapshot of the benefits of CSA activities in the Pru District.

A training on Mobile Weather Alert Messaging organized in the district equipped farmers to use their mobile phones to access daily weather information and when to expect rains. The training programme has enabled farmers to determine the right time to plant their crops and this has resulted in high crop yields. Prior to the implementation of climate-smart agriculture (CSA), farmers were relying solely on seeds that were not resistant to climate change extreme events like drought, pest, and diseases. According to the Department of Agriculture, local crops varieties were low-yielding and were also more vulnerable to climate change threats. Farmers were introduced to novel varieties of crops like Sanzal-sima, Wang-gata and Bihilifa, which even in the midst of drought produce substantial yields to boost farmers' incomes. These crop varieties are resistant to drought, high yielding and takes shorter period to mature. The farmers confirmed that the CSA activities assure them of entry into the next farming season with adequate finance to invest in their farming activities.

4.2.2. Aquaculture (fish cage culture)

Climate change occurrences such as flood, rising water temperature have also affected the local fishing industry. It has resulted in a sharp decline in fish stock in the Pru River and Volta Lake and the crippling of local economic activities in the district. The frequent flooding of these two water bodies prevents fisher folks from harvesting more fish. The Department of Fisheries, the Pru District Assembly and the Business Advisory Centre introduced proactive measures to respond to the dying local fishing industry. Fish cage farming was one of the interventions undertaken to augment fish production, to create employment opportunities and improve the living conditions in local communities in the district. The results are summarized in Table 6.

Table 7. Natural resource utilization and management.

Climate change adaptation programme	Sustainable natural resource utilization and management activities	Outcome of sustainable natural resource utilization and management programme	Responses of the beneficiaries and participants
Sustainable Natural Resource Utilization and Management	• Introduction of Morrison stove. • Afforestation project • Residents are encouraged to prone tree branches for firewood and charcoal burning instead of felling the whole tree.	• It reduces fuelwood use by 39% during the process of fish smoking. • 250 hectares' mango afforestation project in 11 communities. • 182 hectares of exotic trees cultivated under the national forestry plantation development. programme. • Reduction in the number of trees cut for charcoal production and domestic use.	According to Natural Resources and Conservation Department: *Compared to the Chorkor stove, the Morrison stove is environmentally friendly and is more fuel efficient. One of the measures to mitigate and adjust to climate change is the establishment of Mango plantations in some of the communities. We established 250 hectares of mango plantations in eleven communities in the district. We think that these strategies will help us manage the threats of changing climate.* A respondent explained: *The introduction of the new fish smoking technology has been very helpful. We use less firewood in smoking fish which means we will not be cutting trees from the bush. We have started planting a lot of trees too.* (BENE 7)

It is clear that fish farming is an important employment and income generation intervention in the Pru District. It is a key driver of LED in the district and has shored up and accelerated fish production in the wake of climate change threats. to make the livelihood of the local people sustainable. The substantial improvement in the livelihoods of the fisher folks serve as useful lessons for increasing investment in aquaculture in the district.

4.2.3. Sustainable natural resource utilisation and management

The severe climate change impacts in the Pru District make it imperative to formulate and implement development plans that promote efficient utilization of climate-sensitive natural resources. This is particularly vital because employment and livelihoods at the grass root level depend solely on the availability of natural resources. The Pru District is well endowed with natural resources such as water bodies (Volta Lake and Pru River), forest and wildlife and fertile land. To ensure efficient utilization of these natural resources, the Pru District Assembly, with financial support from the Netherlands Development Organisation (SNV) implemented the project ''Improved Fish Smoking and Mangrove Restoration in Action" which aimed to assist fishmongers to reduce deforestation associated with their activities. The project focused on two activities – introduction of efficient fish smoking stoves and agro-forestry. Women involved in fish smoking in the district were assisted to use efficient fish smoking stoves known as the Morrison Stove to reduce pollution and improve the quality of their fish products**.** The new stoves were constructed for demonstration and adoption in six communities in the district; Fanti Akura, Konkonba, Brekente, Kajai, Hutideke, Jaklai Number.1. The agro-forestry intervention facilitated the planting of mango trees on about 250 hectares of land in eleven communities and this helped to reduce the sporadic felling of trees for (Table 7).

According to the Natural Resources and Conservation Department and the District Fisheries Commission, the Morrison Stove is environmentally friendly and is more fuel efficient and reduces the consumption of fuelwood by 39% during fish smoking. The over 80 fishing communities in the Pru District depend largely on firewood which is causing the degradation of the natural vegetation. The mango plantations serve as a CCA and income generation strategy. The Pru District Assembly has planted 250 hectares of afforestation projects in 11 communities; Komfourkrom, Zambrama, Yawpare, Ajaraja-Bepopso, Abease, Bosomfour, Ankrakuka, Krobo, Bomoden, Daman Nkwata, and Kamapa. To ensure sustainable utilization of natural resources in the district, farmers are encouraged to prune natural trees and use the residue as fuelwood instead of felling whole trees.

4.3. Challenges of mainstreaming climate change adaptation

4.3.1. Inadequate resources for climate change adaptation

The review of major CCA programmes such as the Adaptation of Agro-Ecosystems to Climate Change (AAESCC) and Improved Fish Smoking and Mangrove Restoration in Action indicated efficient disbursement of donor funds provided for implementing them. On the contrary, smaller programmes like routine climate awareness and sensitization programmes financed by the Pru District Assembly Common Fund were plagued with insufficient funds and disbursement delays. Furthermore, several agencies such as the Pru District Assembly, Department of Agriculture and National Disaster Management Organisation which played different roles in the implementation of the various climate change adaptation programmes failed to collaborate effectively. This resulted in frequent delays in the disbursement of funds and inefficient implementation of the programmes. The District Finance Officer explained the predicament as follows:

> There are a lot of development programmes in the Medium-Term Development Plan to be rolled out by the district but financial resources are limited. Although we try to find money to support programmes that will fight climate change, the district is cash trapped. It continues to remain the biggest challenge we face in carrying adaptation programmes.

This problem was corroborated by the District Planning Unit:

> The timely release of allocated funds for tackling climate change issues is a major challenge. Although there are a lot of projects

> on the board for execution, the limited financial resources of the district often account for the late disbursement of funds to the various departments responsible for running these climate change programmes.

Analysis of the field data also revealed that CCA programmes that required counterpart funding from the District Assembly suffered from the Assembly's failure to provide its share of the funds timely. Financing CCA programme in the district has been difficult because the Assembly did not prioritize the implementation of climate change issues even though they have been captured in the District's Medium Term Development Plans (MTDPs). The interest of the District Chief Executive (DCE), who is the political head and the representative of the President of Ghana, put his political interests ahead of the real development priorities of the district. This is one of the reasons for the non-commitment of Internally Generated Funds (IGF) for the implementation of CCA programmes in the district. The Assembly is more interested in the implementation of physical and infrastructural projects mainly because they provide political advantage during periods of campaign for re-election to office. Political leaders prefer to spend huge financial resources to provide relief items to farmers than channelling these funds into CCA activities. This often undermined the smooth execution of CCA programmes and served as a discouragement to partner organizations involved in the implementation of CCA interventions.

4.3.2. Inactive stakeholder and institutional collaboration

Mainstreaming CCA into local development process is an official conduit for local government entities to adjust their plans to local climate variability threats. Interestingly, this paper has established a direct relationship between CCA programme partners and stakeholders of other development interventions in the Pru District. With regard to CCA mainstreaming, obstruction of coordinated efforts by stakeholders was exceptionally prevalent. This paper has established that institutional engagement in climate change related actions and the day-to-day decision-making system in the Pru District are rather weak. These weaknesses are evident from the poor manner in which reports on CCA interventions are shared and monitored. The District Assembly tended to use its authority as the lead development agency to undermine decentralized agencies like the Department of Agriculture, National Disaster Management Organisation, and Department of Fisheries and other stakeholders. Stakeholders' inputs and expert advice are often not incorporated in final decisions and conclusions on CCA programmes, their implementation and monitoring. Some stakeholders and officers from these agencies often felt marginalized, unwanted and therefore reduced their level of participation in CCA activities in the district. It was also discovered that allowances due the stakeholders and officials from the decentralized agencies are often not paid. This situation discouraged them from participating fully in the activities which are largely meant to safeguard the livelihoods of the people of the district.

A representative of the Department of Agriculture affirmed this challenge thus:

> This is a critical challenge after inadequate financial resources. We often have to struggle with the officers at the District Assembly who are in charge of disbursing funds for most of the adaptation programmes before it is done. The District Assembly feels superior over other partner agencies in the fight against climate change so other agencies feel marginalised in the process and this affects the partnership between the various stakeholders.

The Department of Fisheries echoed this view:

> Funding may be available but because of the multidisciplinary nature of climate change, it's more prudent to bring stakeholders in the value chain to ensure the objectives of the CCA programmes are achieved. I think this challenge will rank next to insufficient resources.

4.3.3. Lack of continuity of climate change adaptation programmes

The results of this paper indicate that CCA projects undertaken in the Pru District were funded by international donor agencies such as Netherlands Development Organisation (SNV) and the World Bank during implementation periods of four (4) years. Funding for the programmes were withdrawn at the end of the programme period irrespective of the level of impact on the beneficiary communities. In other words, no matter the implementation stage, the programme was truncated and thus suffered from lack of continuity and sustainability. A Pru District Assembly Staff lamented the situation in these words;

> The major climate change adaptation programmes in the Pru District are donor sponsored and the funding only lasts for the duration of the programme implementation. Currently, few of the adaptation programmes are running; the rest have ended which automatically means the funding has ceased and so are the adjustment programmes.

In addition, most of the CCA programmes were implemented in a few selected communities in the district. This implies that only a limited number of communities from the 450 fishing and farming communities benefited from the interventions introduced to strengthen and sustain the livelihoods of the local people. The seemingly low coverage of the adaptation interventions in the district has birthed another challenge; how fast does it take for CCA knowledge to be transferred to other fishing and farming communities in the district? A farmer echoed this challenge thus:

> The Pru District is very large, especially that some island communities are scattered on the Volta Lake and are difficult to reach and are therefore denied the interventions. A community like Yaw Pari is distant from the district capital Yeji so knowledge transfer has become a major problem. (BENE 11)

5. Discussion

Safeguarding livelihoods and employment from climate change threats has been a daunting challenge in the Pru District. A principal premise of this paper is that effective CCA integration in development planning has the capacity to create jobs, reduce poverty and improve rural livelihoods. The analysis of the field data provided convincing evidence to indicate that climate change significantly affected climate sensitive LED programmes such as bee-keeping in the district. For

example, increasing atmospheric temperature, bushfires, drought and rainstorms had enormous impacts on the viability of bee-keeping. The destruction of the bee hive boxes by these climate related events deprived bee-keepers of their income and livelihoods. Bee keeping provides jobs for people in the Pru District. However, the District Assembly (2017) confirmed that honey production in the district has experienced a drastic decline between 23% to 45% depending on the level devastation of bee hives. An important consequence of the decline in honey production and bee-keepers' incomes is a loss of tax revenue in the District Assembly. Pirk et al. (2017) argued that increased temperature may defer plant flowering time and harm honey bees, their habitats and the quantity of honey produced. Farmers who benefited from the micro-credit scheme implemented by Yapra Rural Bank have not been able to pay back their loans. This programme was designed to boost agricultural productivity and improve LED but due to loss of crops caused by climate change threats such as drought, bushfire and floods, the intervention has been suspended. Faleiro et al. (2018) confirmed that these climate change threats affect the operations of micro credit institutions (MCIs) via their support for agricultural activities. Anecdotal evidence suggests that the repayment rate of MCIs is highly correlated with crop production. Most of the customers of these institutions are farmers, and any change in their income affects the MCIs. The lessons learnt from the impact climate change have on LED programmes in Ghana may be useful for development decision-making in other Sub-Saharan African countries where LED programmes are highly responsive to climate change threats. However, the adoption of the lessons learnt from this paper by other countries should be accompanied by rigorous assessment of the local climate situation.

Providing subsidized fishing nets and outboard motors to fishermen was a LED intervention to improve the ailing fishing industry in the Pru District. However, climate change threats such as flood and rising water temperature have diminished the effectiveness of this intervention. Several other studies also confirmed that physical changes in the seas, lakes, and rivers are associated with global climate change which cause diverse destructive impacts on fish, their ecology, the occupations of fisher folks and local economies (Savo et al., 2017). Jones and Cheung (2015) indicated that the adverse effects of changing climate and water temperature directly influence fish stock availability. These events have affected the income levels of fisher folk and rendered them unable to meet their financial obligations. However, the results of the field data analysis also revealed that climate change adaptation programmes that were integrated into pro-poor development interventions in the Pru District have succeeded in building the resilience of farmers and local communities against climate threats. Climate smart agriculture interventions introduced in local communities enabled farmers to read weather messages on their mobile phones and to determine the rainfall pattern and specific planting seasons. Farmers' knowledge of the right time to plant their crops leads to higher crop yields and farmer's incomes at the end of the planting season. Bawayelaazaa Nyuor et al. (2016) also found that timely planting and selection of crops impacts agrarian's income. Owusu and Waylen (2013), stressed that the failure of agriculturists to envisage current planting season could influence crop yields and farmers' revenue.

Among the plethora of challenges inhibiting mainstreaming CCA into pro-poor development interventions in the Pru District, inadequate finance was identified to be the major problem. Yeeles (2018) similarly identified financial constraints as one the biggest challenges of the international community experiences in assisting CCA in developing countries. The multifaceted nature of climate change requires effective stakeholder and institutional collaboration to effectively reduce the vulnerabilities of rural communities to climate change impacts. Analysis of the field data revealed that cooperation among departments and agencies in the Pru District was extremely weak. As is recommended by Cuevas (2016), in order to stimulate diverse opinions for improving the integration process, it is extremely vital to include key partners in the design and implementation of CCA programmes. Dumenu and Obeng (2016) also observed that the pursuit of effective ecological management interventions may be accomplished when institutional structures are all involved. In other words, all relevant local stakeholders within the Pru District should be included in the CCA mainstreaming process. Knowledge transfer is also essential for mainstreaming CCA into the LED process (Mikova et al., 2015). The lack of continuity of CCA programmes in the Pru District did not permit knowledge and innovation transfer and the sustainability of the programmes.

6. Conclusion and recommendations

The concept of climate change adaptation (CCA) mainstreaming on local economic development (LED) agenda has become a popular development strategy in most developing countries in recent years. In Ghana, various medium-term development policy documents have acknowledged the relevance of mainstreaming climate change into development plans across spatial and time scales. This paper examined the impacts of CCA on LED, the process of mainstreaming CCA into LED, the associated challenges and appropriate mitigation measures. Although there is a growing number of studies on CCA, most of them barely examined how climate risks are mainstreamed into pro-poor programmes. The present paper sought to fill this gap and contribute to the body of knowledge on the subject. The life experiences of the participants of the field study conducted in the Pru District provided clear evidence of systematic change in the climate system in the Pru District and the impacts on local economic activities such as farming, bee-keeping and fishing. The paper found that significant efforts and resources have been channelled to implementing LED initiatives in the study location but climate change extreme events such as heat waves, floods, storms, drought, and bushfires have seriously undermined the expected outcome of these initiatives. In order to mininmise the effects of the cycles of extreme climatic events in the district, development actors in recent years decided to integrate CCA in the design and implementation of local development

interventions. An important observation by the authors of this paper is that sustainable LED can be achieved in the Pru District if the existing decentralized agencies and relevant stakeholders are adequately incentivized to effectively cooperate and incorporate CCA actions into LED programmes and activities.

The mainstreaming of CCA into LED programmes in the Pru District could be more successful if measures are introduced to mitigate the identified multifaceted challenges. First of all, it is recommended that a climate change desk should be established at the District Planning and Coordinating Unit of the District Assembly to screen all development programmes to ensure that climate change elements are fully integrated. Secondly, in order to incentivize the officers of decentralized agencies that participate in mainstreaming CCA into LED programmes, the District Assembly should pay the officers allowances. Thirdly, ensuring a level playing field is essential for motivating development stakeholders to actively participate in mainstreaming CCA into LED decision-making process without feeling marginalized. In addition, their views should be captured in the reports of each deliberation. Fourthly, the current district wide performance appraisal system that considered climate change as indicative metric should be strictly adhered to and effectively implemented to motivate local actors to continue lending their support for mainstreaming climate related risks into LED interventions. It is highly recommended that CCA mainstreaming into LED programmes should be allocated at least five percent (5%) of the annual district budget. Furthermore, in order to avoid the hijacking of climate change budget by powerful politicians and administrators, the exact amount of money allocated to climate change associated programmes should be made known to all stakeholders.

Furthermore, sophisticated, pro-active and interactive institutional collaboration is quintessential for effective integration of CCA into LED initiatives. Offices responsible for mainstreaming CCA into LED programmes should be provided qualified officers, clear mandates, and sufficient resources for achieving the expected results and outcomes. To promote the transfer of knowledge and innovation on mainstreaming CCA into LED activities in other communities in the district and facilitate the replication of best practices learnt from previous LED programmes, the District Assembly, Department of Agriculture and Department of Fisheries should build the capacity of the leaders of farmer cooperatives and members of Artisanal Fishermen Associations to be trainers of their members. This strategy will be less costly and effective in transferring the adaptation knowledge district wide. It also important to note that further research is needed to explore more innovative ways through which local governments in Ghana could raise funds locally, nationally and internationally for financing CCA programmes. To establish adequate understanding as to why the lead implementing agency (the Pru District Assembly) of CCA mainstreaming into LED programmes tended to undermine the other relevant key stakeholders also requires further research. Finally, more research would be necessary to discover the extent of indigenous CCA knowledge and its relevance for building the resilience of local communities and development stakeholders on a sustainable basis.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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