African Geographical Review

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rafg20

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To cite this article: Daniel Adu Ankrah, Andrew Agyei-Holmes & Alfred Asuming Boakye (2021): Participatory farm budgeting – A case of pineapple farmers in ghana, African Geographical Review, DOI: 10.1080/19376812.2021.1958691

To link to this article: https://doi.org/10.1080/19376812.2021.1958691

Published online: 11 Aug 2021.

AFRICAN GEOGRAPHICAL REVIEW
https://doi.org/10.1080/19376812.2021.1958691

Routledge
Taylor & Francis Group

ARTICLE

Participatory farm budgeting – A case of pineapple farmers in ghana

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ABSTRACT

This article articulates the usefulness of a participatory farm budget in addressing challenges associated with the recall of agricultural prices, inputs, outputs, and estimate biases in the global south. The study is foregrounded in a qualitative paradigm. Participatory farm budgeting is a method that permits stakeholders to analyze, quantify input, output resources, and farm profit. The method highlighted higher economic returns associated with sucker production, an aspect neglected and trivialized by the conventional farm methods. We recommend dedicated attention to harness the economic benefits derived from sucker production through the radical use of the participatory farm budget.

ARTICLE HISTORY
Received 18 January 2021
Accepted 14 July 2021

KEYWORDS
Participatory farm budget; pineapple farmers; Ghana; Millennium Development Authority

Introduction

Farm-level resource allocation and use remain a challenge to several smallholder farmers in the global south. Most smallholders do not take into account the direct link between farm inputs and outputs, hence remain unable to properly account for farm enterprise profitability. Batista and Vicente (2020), Glover and Jones (2019), and Leonardo et al. (2018) demonstrated that farming is not lucrative owing to poor record-keeping that does not provide an opportunity for the tracking of investment and returns. Even in the few cases where smallholder farmers keep records, they are outdated and inaccurate. Farm records however constitute a valuable document that helps farmers assess profitability. Barnes et al. (2020) indicated that the absence of farm records leads to difficulty in evaluating a farmer's performance, financial viability and profit. Lalani et al. (2017) argued that the non-keeping of farm records can be attributed to high illiteracy rates among farmers, which culminates in the inability to keep accurate and current records.

The use of conventional farm management methods appears populist, despite its heavy reliance on the use of formal complex methods for computing farm profits. It has been criticized to be uneasy to use by semi-illiterate and illiterate farmers. This led to Participatory Rural Appraisal (PRA) tools. The use of PRA approaches has shown that farmers can sketch diagrams, draw maps, rank and score. Gill (1993) argued that the ability to score and rank shows that semi-illiterate and illiterate farmers possess proficiency in numeracy. The PRA encourages an affinity to processes, information and understanding by farmers. The PRA served as a useful reference that birthed participatory farm management (PFM) methods (Galpin et al., 2000). This was based on limitations and lessons drawn from the PRA, therefore PFMs are complementary tools to PRAs and not alternatives.

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Dorward et al. (2007) defined participatory farm management methods as the use of simple tools that inclines independent farmers, extension workers and farmers or researchers to assess farming activities, quantify inputs use, production and the allocation of resources that generates outputs for a farm enterprise. Participatory farm management methods include scored causal diagrams, participatory budgets, resource allocation maps and resource flow diagrams (Galpin et al., 2000). Participatory farm budgeting is a method that allows farmers and researchers/extension agents to analyze and quantify inputs and output resources for a farm enterprise over a given period (Galpin et al., 2000). Participatory budget emanated from traditional indigenous games. For instance, in Ghana, the *Oware* game that involves the use of counters guided the participatory farm budget tool. Compton (1995) showed how the *Oware* game was successfully used to promote partial cost-benefit analysis among agricultural extension agents in Ghana. It is interesting how an indigenous game birthed the participatory farm budget, a basis that justifies why Ankrah et al. (2021) advocated for the integration of indigenous knowledge into science-based approaches. The participatory farm budgets involve the use of counters and symbols on a board with activities captured in rows and periods in columns. Participatory farm budgets are used to compute farm profits by assigning resources monetary values. The method offers the analysis of evaluating different contexts on the timing, production and resource use and allocation (Dorward et al., 2003). The methods depart from the profit maximization assumption to consider other farmer motives that receive less attention. The motives include production for barter exchange, prestige and household food security. Galpin et al. (2000) argued that conventional farm budgeting methods focus on profit and loss without consideration to other non-financial inputs and outputs. Additionally, they are often complex and difficult to use by farmers, often neglect seasonalities and changes over time. Participatory farm budgets are easy to use, considers non-cash resources, accounts for resource use over time and are implemented through the use of local materials (Galpin et al., 2000).

Participatory farm budgets have however been criticized to be time-consuming, non-appealing and too basic to literate and commercial farmers. The methods have an excessive inclination to qualitative approaches by neglecting some aspects of the quantitative methods of analysis. The weaknesses associated with participatory farm budgeting can be surmounted through its flexible nature that allows for an adaptation to a given context. Additionally, a blend of the quantitative and qualitative approaches can be fairly integrated.

The need to integrate participatory farm budgeting into conventional budgeting approaches remains critical in the attainment of Sustainable Development Goal (SDG) – 1 (end poverty) and SDG-2 – (zero hunger) particularly in the global south where copious record-keeping remains a challenge (Dorward et al., 2003, 2007; Ubungen et al., 2020; Worku et al., 2020). A relevant research question that readily comes to mind is Why the need to integrate the use of participatory farm budgeting into conventional farm management tools? The seminal works by Dorward et al. (1997) argued that participatory farm management tools enable researchers and farmers to assess resource allocation and efficiency at the farm level with its implication for innovation implementation. Their works summarized that participatory farm management tools enable farmers and researchers to identify farmer constraints, examine the effect of interventions on resource use and allocation at the farm level including on-farm trails, extend beyond the quantification of resources related to revenue, financial in-flows and profit, but also examine non-cash resources that are relevant to production (Galpin et al., 2000).

Agricultural sectoral challenges including efficient farm management attracted donor, multinational, government and development partners' attention including the United States of America (USA). The USA made available the Millennium Challenge Account (MCA) grant to Ghana that targeted modernized agriculture and major challenges that confront the sector. The MCA programme under its agricultural component, dedicated aspect of the grant to training, capacity building, improving farm efficiency, education and training on-farm records. This involved participatory farm management and participatory rural appraisal tools (Please see Section 3.1.)

Kanyenji et al. (2020), Makate et al. (2019), and Yigezu et al. (2018) highlighted challenges associated with low technology uptake and improvements in farm efficiency among smallholder farmers. Consequently, development practitioners continue to search for novel ways of addressing these challenges. Critical to this, is the measurement of technology adoption and computations of farm efficiency. Coteur et al. (2018) argued that several participatory farm tools exist in assessing and supporting sustainable agricultural innovations. However, they remain limited because such tools are unable to address the complexity that exists among smallholder farmers. Dorward et al. (2007) earlier explored the use of participatory farm tools in addressing potential challenges associated with the recall of past agricultural inputs and outputs. But this received limited use particularly in the global south where such challenges persist and perhaps to a greater extent. Iwanaga et al. (2020) recently used participatory farm management tools in addressing the recall of agricultural inputs and impacts of innovations, such recent studies however remain rare. Despite, the evidence adduced by Capaccioli et al. (2017); Scherhaufer et al. (2018) in the extant literature that showed that participatory farm management tools are useful in the agricultural and non-agricultural sectors (energy, health, education). Bradfield et al. (2020), Cann et al. (2020), Schimmelpfennig (2016), and Wongnaa et al. (2019) exemplified that most studies examined farm profit, resource use and gross margin analysis from the perspective of administering cross-sectional questionnaires to farmers which relies heavily on individual recall. Although, recall of past agricultural inputs, outputs and prices remain a challenge. This can potentially lead to inaccurate and bias estimates.

Linear programming models have been used to evaluate resource use, efficiency and allocation. For instance, Galán-Martín et al. (2015) used linear programming to identify optimum cropping plans and maximum net returns in Spain. Wankhade and Lunge (2012) used linear programming to assess the optimal land allocation for 10 major crops in India. Grabowski and Kerr (2014) used partial budgeting to evaluate conservation agriculture adoption in Mozambique. These studies have not been able to address estimate and recall challenges even though they rely heavily on recall. Additionally, these conventional farm management tools have been criticized to be unreliable, data-dependent, complex and scholarly as it presents a blurred picture of actual farm profit and resource use especially in the developing country context where accurate farm records are considered trivial by smallholders. They additionally, assume homogeneity of farming conditions, further assume that high inputs culminate into high outputs, they are biased toward tangible resources and skewed in terms of information flow. The literature on the conventional farm management tools has failed to extensively examine how such tools addressed recall and estimate bias challenges. The few studies that attempt to use participatory farm budgeting tools to address such challenges have remained outdated and limited.

This study contributes to the scarce and outdated extant literature in three ways; First, the paper brings out the usefulness of the participatory farm budgeting tool in addressing a longstanding challenge related to recall of past agricultural inputs, outputs and consequently smallholder profit margins by building on the limited use of the participatory farm budget by Dorward et al. (2003), Dorward et al. (2007), and Dorward et al. (1997). Secondly, it underscores the potential use of participatory farm budgeting in documenting actual profit margins associated with the use of specific pineapple innovations – thus reducing estimate biases. This is insightful because most computations of farm profits dwell heavily on cross-sectional estimates elicited from farmers by external persons with limited farmer participation in the processes. Additionally, this manuscript contributes to the methodological use of the participatory budget tools by farmers in their gross-margin estimations. Third, the article contributes to the usefulness of the participatory farm budget in systematically chronicling pineapple innovations particularly in exploring new project intervention on resource use and allocation at the farm. Hence the comparison between the MiDA and Non-MiDA FBOs. This extends, Dorward et al. (2003) study that examined the suitability of participatory farm budgeting tools in assessing tomato innovations in Ghana. The pineapple sector is one of Ghana's most developed non-traditional crops. The contribution of the sector to Ghana's economy is phenomenal and it involves a lot of

smallholders who are non-sophisticated, hence the need to use a simple tool that allows an understanding of resource use and profitability is essential for farmers, extension and research – thus extending both the theoretical and methodological contribution. The paper aims to examine the usefulness or otherwise of a participatory farm budget in addressing estimate bias, recall challenges and innovations associated with the MiDA project intervention in Ghana's pineapple industry.

2.1. Methodology

Research design

The study employed a qualitative research design that involved the use of Focus Group Discussions (FGDs), Key Informant Interviews (KIIs) and a participatory budget. Gray et al. (2017) indicated that qualitative research enquiry permits the in-depth study of reasons underlying a phenomenon using qualitative methods. An exploratory survey was conducted from January to March, 2012 in Nsawam Adoagyiri Municipal and Effutu District. The exploratory survey constituted a reconnaissance study that identified innovations among crop farmers. The results of the exploratory study showed that pineapple was the only crop with a diversified array of innovations relative to the other crops cultivated due to the stringent export requirements. First, consideration for the study site was informed by the overarching research question of how participatory budget is used to address resource use, allocation, estimation biases and stakeholders (farmers, researchers and extension agents) computations of farm profit. Against a background that pineapple is the most developed within the traditional export crops with a lot of farmers whose educational level falls within semi-illiterate to illiterate. These categories of farmers require the use of simple farm management tools that can assist them to compute gross-margin analysis. Pineapple production demands a high input use owing to the stringent export requirements and the production processes, hence the need to understand the direct link between inputs and outputs, profit margins and allocative efficiency. The study initially considered pineapple frontiers (Nsawam Adoagyiri Municipal and Effutu District). We found out that the Millennium Development Authority (MiDA) promoted various innovations in the two sites (Please See Section 3.1). The grant amount ($547 million) represented a very substantial amount toward agricultural modernization. This warrants an interest in examining how such a grant contributed to pineapple innovations. In the Effutu District, there were limited non-comparison group (non-MiDA) FBOs engaged in pineapple production coupled with few MiDA FBOs. The Nsawam Adoagyiri Municipal was subsequently selected because the municipal had fourteen MiDA FBOs and two non-MiDA FBOs involved in pineapple production and this was more representative.

Secondly, the selected municipal represents a site typical for pineapple production – a frontier for pineapple production that started in the early 1950s (Ankrah, 2014, 2021; Ankrah & Freeman, 2021). Third, we note that even though the production of food crops existed, pineapple remained the main source of income (Ankrah, 2014; Ankrah & Freeman, 2021).

2.2. Methods and participants selection

A participatory budget was conducted for both MiDA and non-MiDA FBOs covering the period before the inception of the MiDA programme ("2008) and the period during and after the inception of the MiDA programme (2008–2012). The reference period for the before 2008 period covered 2005 to 2008. Four MiDA FBOs (Fotobi, Pokrom Patriotic, Nsabah and Apesika) were involved in a participatory budget. All the FBOs involved in the participatory budgets were categorized under the same level of technology by the Department of Agriculture (DoA). The FBOs had been in operation for a similar number of years (at least 5 years). Two non-MiDA FBOs (Oman Fruits Cooperative Society and Enkakyi Cooperative) were selected.

Purposive sampling guided the study. Ames et al. (2019) indicated that purposive sampling helps to select 'representatives' of a population based on a researcher's judgment. Seven (7) MiDA FBOs were purposively selected from fourteen MiDA FBOs. Focus Group Discussions (FGDs) were conducted for both MiDA and non-MiDA FBOs based on theme saturation i.e., where no new themes emerged from the discussion. Five (5) FGDs were conducted on five MiDA FBOs and two (2) non-MiDA FBOs making a total of 7 FGDs. The participants of the FGDs for both FBOs were purposively selected in addition to key informants based on the issues that emanated from the FGDs to gain an in-depth and better understanding of the pineapple value chain.

Methods of data collection

Focus Group Discussions (FGDs)

Hennink (2013) defined Focus Group Discussions (FGDs) as a qualitative research enquiry that focuses on a specific issue with a purposively selected group of participants typically ranging between 6–10 engaging in an interactive discussion with a facilitator. This permits the sharing of different worldviews among participants. Nyumba et al. (2018) indicated that, the researcher's role is that of a facilitator who moderates the discussion between participants and not between the researcher and the participants. The use of FGD remains widely used in studies involving qualitative approaches. A focus group guide was developed to elicit information on the pineapple production value chain including, land preparatory activities, quantity and cost of agro-inputs purchased, number of times agro-chemicals were applied, cost of pineapple suckers, use of plastic mulch, forcing, labor cost associated with all farm activities, quantities of pineapple fruits harvested and sold, the total cost of production, revenues obtained from pineapple sales, post-harvest activities involving sucker production. This information was captured onto a flip chart together with the associated total cost of production and revenue computed. Profit margins were obtained through the difference between total revenue and total cost of production.

The researchers conducted a total of 7 FGDs (6 people per group) to elicit views on inputs and outputs associated with pineapple production by examining plausible effects of the MiDA programme on both MiDA and non-MiDA FBOs. Five (5) and two (2) FGDs were conducted for the MiDA FBOs and non-MiDA FBOs respectively (Ankrah, 2014; Ankrah & Freeman, 2021). The FBOs were purposively selected through the assistance of the Agricultural Extension Agents (AEAs) for the municipal assembly. The second level involved purposively selecting ten (10) farmers taking into consideration their farming experience, gender, literacy level, record-keeping history, the scale of operation, input use and allocation. This was based on initial exploratory interactions with the FBOs.

Participatory budgeting

Participatory budgeting was used because of challenges associated with the recall of agricultural inputs purchased, prices and outputs. This was coupled with the fact that farmers rarely kept records of their past farming activities. The use of a participatory budget remains a suitable method that needs to be employed especially in a developing country context where illiteracy is high among farmers. This allowed participants to arrive at close estimates for agricultural inputs and outputs. Dorward et al. (2003) indicated that the use of participatory budgets enables the farmer together with the researcher to quantify and allocate resources associated with various production activities over a period for an enterprise.

Four FBOs were purposively selected. Participants for the participatory budgets were purposively selected against given criteria such as ownership of farmland within 0.2–2 hectares, same years of farming experience, production of the same pineapple varieties, similar age group range, the same agro-ecological zone for pineapple production and the selection of FBOs with same

technology adoption level. The second stage also involved the purposive selection of select six (6) respondents. This system allowed for the similar characteristic between both MiDA and non-MiDA respondents and therefore any differences observed could be attributed to specific innovations used and the MiDA programme.

Participants were gathered in the form of a focus group discussion and each group was asked to nominate a member to write all the inputs and associated costs involved in pineapple production on a flip chart provided. The participatory budgeting covered pineapple production over the period before 2008 and the period from 2008 to 2012. Farmers made use of symbols and diagrams to represent inputs purchased and sold. Four participatory budgets were conducted for MiDA FBOs (Fotobi, Apesika, Nsabah and the Pokrom Patriotic Cooperative) and two non-MiDA FBOs (Oman and Enkakyi Cooperatives). This activity was farmer-led.

- Key Informant Interviews (KIIs)

Key informants were purposively selected based on issues that emanated from the FGDs to gain deeper insights. A semi-structured interview guide was developed in guiding interviews. Liu et al. (2020) indicated that key informant interviews permit researchers to obtained more nuanced information from individuals who hold knowledge about a subject under investigation.

Table 1 below shows a total of 20 key informants were purposively drawn from the MiDA, Central Management Consultants (CMCs), Technical Training Service Providers (TTSPs), Blue Skies Ghana Ltd Company, Ministry of Food and Agriculture (MoFA), Combined Farms and FBOs. The interview guide enabled researchers to elicit information on the pineapple value chain including, land preparatory activities, agro-inputs usage and purchases, cost of pineapple suckers, use of plastic mulch, forcing, labor cost associated with all farm activities, quantities of pineapple fruits harvested and sold, the total cost of production, revenues obtained from pineapple sales, post-harvest activities involving sucker production.

Analysis of data

Information on computations captured on flip charts on pineapple production was transferred into notebooks and consequently captured on a computer. Other text information and discussions that took place during the FGDs were transcribed. The transcribed data was entered into

Table 1. Summary of key informant interviews.

Origin of Key Informants	Number of Key Informants	Profile of Key Informants
Blue Skies Ghana Ltd Company	2	Agronomist and an Assistant Agronomist with Blue Skies Ghana Ltd Company
MoFA	2	An Agricultural Extension Officer & a Management Information Systems (MIS) Officer with the Department of Agriculture – Nsawam Adoagyiri Municipal Assembly
Combined Farms Ltd	2	Farm manager & a laborer at Combined Farms Ltd
MiDA FBOs		
Adonten	2	A member of Adonten FBO and local chief of Pokrom village and a chairperson of Adonten FBO.
Nsabah	2	A chairperson and a member of Nsabah FBO
Fotobi	2	A chairperson and a member of Fotobi FBO
Apesika	2	A secretary and a member of Apesika FBO
Pokrom Patriotic	2	A chairperson and a member of Pokrom FBO
Non-MiDA FBOs		
Oman Vegetables	2	A chairperson and a member of Oman FBO
Enkakyi	2	A chairperson and a secretary of Enkakyi FBO
Total	**20**	

Source: Fieldwork, 2012; Ankrah (2014); Ankrah and Freeman (2021).

a Nvivo 12 software. The researchers first familiarized themselves with the themes emanating from the transcribed data. A criteria was developed and agreed upon by the researchers. This eventually helped to identify themes that emerged. Major and sub-themes were identified and based on a thematic approach, a coding system was developed categorizing themes under major and sub-themes. This was done based on an inductive approach (Kayapinar, 2014). Information was captured into Nvivo as nodes. Whenever a new theme emerged it was captured as a new node in Nvivo. This iterative process was undertaken until theme saturation was observed. Thematic analysis was conducted and statements illustrative of themes were quoted directly in the findings.

3.1. Study context and MCA programme background

Ghana's economy is largely agrarian-based with a population of 24,658,823, less than half (41.2)% of the economically active population are skilled agricultural, fishery and forestry workers, 21% are service and sales workers with the remaining 15.2% being craft and related trade workers (GSS, 2012). Fourty-six (46%) of households are agricultural households with most (95.1%) engaged in crop farming (GSS, 2012). The pineapple crop is the first non-traditional export crop cultivated in the Eastern, Central, Greater Accra and Volta regions of Ghana in the 1950s (Ankrah, 2021; Kleemann et al., 2014; Krumbiegel et al., 2020; Williams et al., 2017). The Ghana Living Standard Survey indicated that a small proportion (2%) of households cultivate pineapple (GLSS, 2008). Pineapple production in the Eastern Region is found in the Nsawam Municipal Assembly. The assembly is between latitude 5′.45 N and 5′.58 N and longitude 0.07′W and 0.27′ W with the capital town being Nsawam. The municipal stretches over 175 square kilometers. The population of the Municipality according to the 2010 population and housing census shows was 86,000 made up of more (43,267) females than males (42,733). The municipal has a double rainfall (major and minor season) pattern with the major rains between May to June and the minor rain in September to October. The precipitation is between 125 cm to 200 cm with a temperature range between 26°C to 30°C. The ecological zone is the semi-deciduous forest and coastal savanna grassland with a greater proportion (90%) of the municipal covered by forest. The ecological zone is suitable for pineapple production.

The export of pineapples in Ghana started in 1950 with a rapid increase in the 2000s and a decline after 2004 (Ankrah, 2021). The industry had cumulative growth of 172% between 1994 to 2004 (Williams et al., 2017). The decline was due to the shift in the demand from the smooth cayenne to the MD2 variety (Kleemann et al., 2014). The MD2, therefore, became a preferred variety. Ghana's pineapple sector is dominated by many smallholder farmers with few medium and large-scale farmers. Indeed, Gatune et al. (2013) estimated that 50% of smallholder farmers produced fresh pineapples for the export market. The educational level of the farmers falls within the semi-illiterate and illiterate farmers.

The Millennium Challenge Corporation (MCC) through the Millennium Challenge Account (MCA) provided Ghana with a five-year compact of $547 million grant that targeted poverty reduction through improvement in farmer profitability led by the private sector. The MCA Ghana programme emphasized boosting the productivity of high-value cash crops including pineapples as well as food staple crops in some selected areas. This objective was to eventually enhance the competitiveness of Ghana as a major export base in terms of horticultural and other lesser-known traditional crops ("MiDA," 2008). As part of this objective farmers were taken through resource allocation and efficiency (farm management), record-keeping, business plan development, efficient marketing, post-harvest management, agronomic training, conventional and participatory farm budgeting (Ankrah, 2014; Ankrah & Freeman, 2021)

The MCA Ghana programme was derived from the existing sector policy document known as the Food and Agriculture Sector Development Policy (FASDEP II). FASDEP II envisages a market-driven growth through the utilization of resources and commercialization of agricultural activities.

The objective envisioned under the crop sub-sector includes enhancing the competitiveness and profitability of crops through the promotion of horticultural, industrial, food crops and mechanized agriculture. The improvement in growth in incomes will be achieved by increasing farmers' productivity and profitability through commodity value chains, the application of science and technology with environmental sustainability as a key component (Ii & M. o. F. a. Agriculture, 2007).

The MCA programme operated in 30 districts in Ghana that were zoned into three namely: the Northern Agricultural Zone (NAZ), the Afram Basin (AB) and the Southern Horticultural Belt (SHB) ("MiDA," 2008). In Ghana, the MCA programme was managed by the Millennium Development Authourity (MiDA). Under the MiDA programme, farmers belonging to FBOs were taken through various training modules targeted at building farmers capacity toward increasing farmers' productivity and profitability. The pineapple crop was among the high-value crops that were targeted under the MiDA programme.

4.1. Results and discussions

Table 2 below shows a participatory budget for two MiDA FBOs namely Fotobi and Pokrom Patriotic. There are three main pineapple varieties – the sugar loaf, smooth cayenne and the MD2. Before the year 2008, these FBOs were involved in the cultivation of smooth cayenne. Smooth cayenne cultivation does not require the use of plastic mulch (Sanewski et al., 2018), plowing and harrowing. The period covering 2008 to 2012 involved the production of the MD2. The participatory budget was created based on the cultivation of smooth cayenne before 2008 and the cultivation of MD2 after 2008 (2008 to 2012). This was computed based on the cultivation of an acre farmland. The variable costs included cutlass, wellington boots, knapsack sprayer, gloves, protective clothing, water drum, mattock, hoe, shovel and nose mask. Generally, we note that pineapple production is dominated by more males. This finding is not a departure from the common feature of male domination in most cash crops found in Ghana. A plausible reason could be due to what Ankrah et al. (2020) ascribed to the differential access to productive resources in Ghana. Additionally, we observed a transition of smallholder farmers into medium-scale as confirmed by Kwapong et al. (2021) in the case of maize and cassava farmers.

The participatory budgeting tool was used to systematically list the entire production activities and innovations associated with pineapple production. The tool appeared very useful in addressing recall of past agricultural inputs, innovations and costs associated with specific innovations. Typically, twenty thousand (20,000) suckers are planted on an acre of land for smooth cayenne production whilst the MD2 requires twenty-four thousand (24,000) pineapple suckers for an acre of land. Pineapple suckers are graded into small, medium and large. Dipping and drenching is undertaken afterward. Dipping is done before planting pineapple suckers. Generally, we observed that most pineapple innovations are easily transferred peer-to-peer. This finding is supported by Kwapong et al. (2020) who indicated in their study in southern Ghana, that the deficit in

Table 2. Participatory budget for Fotobi and Pokrom Patriotic MiDA FBOs.

	Participatory Budget for MiDA FBOs			
	Fotobi Cooperative Society		Pokrom Patriotic Cooperative	
Activities	Before 2008 (GH¢)	2008–2012 (GH¢)	Before 2008 (GH¢)	2008–2012 (GH¢)
Total Cost of production for 15 months	9,59.11	2,315.27	2,168.43	2,619.54
Total revenue after obtained in 15 months	2,101.18	4,063.66	3,814.24	4,944.12
Profit after 15 months	1,142.06	1,748.39	1,645.81	2,324.59
Total cost of production in 3 years	1,091.61	2,497.30	2,405.31	2,559.94
Total revenue in 3 years	6,504.28	13,816.46	8,377.94	13,494.75
Profit in 3 years	5,412.67	11,319.16	5,972.63	10,934.81

Source: Fieldwork, 2012.

agricultural extension officers, rendered underserved communities to resort to peer-to-peer extension.

Planting of suckers included the cost of transportation of suckers to the site, grading of suckers, carriers for conveying suckers to the farm and the cost of labor for planting the suckers. The plowing activity in the participatory budget captured two phases (first and second plowing). Before 2008, both MiDA and non-MiDA FBOs had limited use of farm tractors for plowing and harrowing. Only a few rich farmers' were able to afford tractor services. This finding is consistent with Takeshima et al. (2018), Takeshima and Liu (2020), and Van Loon et al. (2020) who observed limited use of tractors among smallholders.

During the participatory budget with MiDA FBOs, farmers indicated that:

> *"Even though pineapple is a high-value crop and we tend to gain high profits, we rarely used tractor in our operations. This was because we were not exposed to the technology hence lacked the technical know-how to operate" (Fotobi Cooperative, FGD/3rd /February/2012).*

The use of tractors for plowing and harrowing helped improved farm efficiency. Non-MiDA FBOs complained about tractor cost but the results from the gross-margin analysis proved otherwise. Despite the high production cost associated with the use of farm tractors and plastic mulch, results obtained from the participatory budget indicated increased farm profit for MiDA FBOs (before 2008 and after). Non-MiDA FBOs on the contrary recorded a decline in profits after 2008 even though they did not use farm tractors and plastic mulch in their production activities. This was partly due to a decline in demand for smooth cayenne on the world market. Kleemann et al. (2014) supported this finding. It came up during the participatory budget that the use of MD2 had been an innovation that inured to the advantage of the MiDA FBOs. Indeed, the participatory budget approach permitted participants to recall past agricultural inputs and outputs obtained in a participatory manner that allowed for consensus building on realistic prices obtained in the past. This appeared more rigorous and useful as opposed to just consulting several individuals in a cross-sectional survey. Capaccioli et al. (2017), Dorward et al. (2007), Iwanaga et al. (2020), and Roche et al. (2020), and Worku et al. (2020) gives credence to this assertion.

Weedicide application is done after a month of planting suckers. This activity is performed twice. In a key informant interview with a representative with the Department of Agriculture, it was reported that:

> *"Framers generally control weeds through the application of weedicide a month after planting pineapple suckers. A month is a reasonable time to control weeds because one does not need to wait too long" (DoA KII, 8th/02/2012).*

During the participatory budget, MiDA FBOs indicated that:

> *"Once we plant our suckers, the next activity important for us is to control weeds. Therefore, we control for weeds a month after planting pineapple suckers" (Pokrom Patriotic Cooperative, FGD/22nd/04/2012).*

Non-MiDA FBOs also indicated that:

> *"We control for weeds generally a month after we plant our pineapple suckers. We believe that this is an appropriate period to control weeds" (Oman Vegetables Cooperative, FGD/22nd/04/2012).*

Fertilizer application follows after a month of weedicide application. The fertilizer application involves both solid and liquid fertilizer applications. Liquid fertilizer application is performed twice. Manual weeding with a cutlass is undertaken after the fertilizer application. This activity is performed averagely on four different occasions. Insecticide application is undertaken to control insects. A month is allowed to elapse before forcing is undertaken. Espinosa et al. (2017) described artificial forcing as a practice to synchronize flowering by using ethylene. Forcing is typically done nine months after planting. After forcing, one hundred and fifty (150) days is allowed before harvesting the MD2 variety. In the case of the smooth cayenne, a period of one hundred and thirty-

five (135) days is allowed. This practice was widely reported by all FBOs. In a participatory budget with MiDA FBOs, farmers indicate that:

> *"We allow 150 days after forcing before we harvest MD2 and also allow 135 days for the smooth cayenne. The two varieties are different, hence possess unique features and production technologies" (Apesika Cooperative, FGD/22nd/04/2012).*

In the participatory budget, it was assumed that 80% of fruits harvested were either exported or made available on the local market. Twenty percent (20%) of fruits were assumed to go waste. We observed from the participatory budgets that the MiDA FBOs were able to sell a greater proportion of their fruits to the export market than non-MiDA FBOs. This finding is consistent with the findings of Krumbiegel et al. (2020) who indicated improved market access for assisted groups. The wasted fruits were computed as a cost to the farmer (imputed cost). It must be noted that own labor, as well as other costs indirectly incurred by the farmer, were captured as imputed costs.

Table 2 shows profits obtained after 15 months of pineapple fruits and sucker production were higher for both before and after the MiDA programme and also for MiDA and non-MiDA FBOs. The MiDA FBOs – Fotobi Cooperative obtained a profit of GH¢ 1,142.06 (before 2008) and GH¢ 1,748 (2008 to 2012). Pokrom Patriotic FBO also recorded GH¢ 1,646 (before 2008) and GH¢ 2,325 from 2008 to 2012. These profits obtained were consistent with the average profits (GH¢ 1,318.4, GH¢ 1,531.2, Gh¢ 1,733.8 and GH¢ 2,340.2) that were reported for a treatment group in a MiDA baseline survey (Osei-Amponsah et al., 2012).

A net profit of GH¢ 5,412.67 was recorded at the end of 3 years by Fotobi FBO before the inception of the MiDA programme whereas a profit of GH¢11,319 was recorded after the commencement of the MiDA programme. This represents a significant increase in profit, most of the profit was due to sucker production which is considered trivial. This study shows that sucker production deserves recognition. Thus, this study accounted for cost and revenues made from sucker production, an area that is often neglected by stakeholders. Sucker harvesting takes place two to three months after harvesting pineapple fruits. Typically, pineapple suckers can be harvested on eleven different occasions if proper agronomic practices are adhered to. Sibomana et al. (2016) indicated that losses are narrowly viewed from a single food chain perspective instead of what Alexander et al. (2017) prescribed to be the 'wider food chain.'

We observed increases in profit (before and after 2008) in the case of the MiDA FBOs. It is worthy to note that even though the period after 2008 saw the commercial cultivation of MD2, higher profits were recorded. This is against the backdrop of the high cost associated with MD2 cultivation. A plausible reason can be the prominence that the MD2 gained on the export market to the detriment of smooth cayenne and sugar-loaf. Fischer and Wollni (2018) and Whitfield (2017) gave credence to this finding that MD2 gained prominence as a preferred variety. The surge in demand for MD2 created a market niche for the product and directly created an increased demand for MD2 suckers. Additionally, the demand for MD2 incentivized more new entrants to join.

The MiDA programme made available MD2 suckers to MiDA FBOs. The cultivation of MD2 is accompanied by the use of plastic mulch and the raising of beds. It was observed from the participatory budgets that before the MiDA programme, most FBOs had limited use of plastic mulch in commercial quantities. The MiDA programme encouraged the intensive use of plastic mulch. In a focus group interview, MiDA FBOs indicated that:

> *"Through the MiDA programme, we were given MD2 suckers and plastic mulches to use. On our, we could not afford to purchase commercial quantities of plastic mulch to use but the MiDA programme made this happen" (Nsabah Cooperative, FGD/22nd/04/2012).*

The MiDA programme made an indirect pathway through the provision of limited loans which facilitated some FBOs to purchase plastic mulch. Both MiDA and non-MiDA FBOs however complained about the high cost of plastic mulch. We however observed that MD2 production

helped the MiDA FBOs to increase their competitiveness on the global market thus improved farm profits (See Table 2 below).

Table 3 below shows a participatory budget for two additional MiDA FBOs Nsabah and Apesika Cooperative Societies. The Nsabah Cooperative obtained a profit of GH¢ 1,100 (before 2008), GH¢ 1,854 (2008–2012), Apesika Cooperative Gh¢ 1,058 (before 2008), GH¢ 1,390 (2008–2012) after fifteen months of pineapple fruits harvest. Profit after three years of production for Nsabah and Apesika FBOs yielded GH¢ 6,242.77 (before 2008), GH¢ 11,406 (2008–2012), GH¢ 7,042 (before 2008) and GH¢ 10,483.20 respectively. The results obtained show increases in profit from the sales of pineapple suckers. The trend observed with these two additional FBOs did not differ from what was observed with Fotobi and Pokrom Patriotic FBOs, further giving credence to the findings earlier observed.

Table 4. below also shows the participatory budget for two non-MiDA FBOs namely the Oman Fruits and Enkakyi. Contrary to the MiDA FBOs, these two non-MiDA FBOs did not undertake any form of plowing and harrowing. This is because of the dominant variety (smooth cayenne) cultivated. The non-MiDA FBOs did not use the MD2, because of the perceived high production costs. This notwithstanding, higher profits were recorded after three years of production by the MiDA FBOs. Kuwornu (2013) also observed a similar finding where certified farmers obtained higher profits than non-certified farmers in Ghana.

Oman FBO made a profit of GH¢ 1,566.45 (before 2008), GH¢ 1,019 (2008–2012) whilst Enkakyi FBO recorded relatively higher profits of GH¢ 1,832.51 (before 2008) and GH¢ 1,549 (2008–2012) after fifteen months of fruits sales. The results obtained after fifteen months of production showed a consistent decline in the profit margins in the case of the non-MiDA FBOs (See Table 4).

Similarly, the MiDA FBOs, non-MiDA FBOs recorded significant profits in the sale of pineapple suckers. Oman FBO recorded a profit of GH¢ 6,392.13 (before 2008) from the sales of pineapple suckers and GH¢ 5,708.09 (2008–2012). The decline in the sale of suckers during this period could be attributed to the shift in focus from the smooth cayenne to the MD2. Similarly, Enkakyi FBO also observed the same trend in profit from the sale of pineapple suckers. A profit of GH¢ 6,642.47 (before 2008) and GH ¢ 5,460.55 (2008–2012) were obtained. We conclude that non-MiDA FBOs profit declined during the

Table 3. Participatory budget for Nsabah and Apesika MiDA FBOs.

	Participatory Budget for MiDA FBOs			
	Nsabah Cooperative Society		Apesika Cooperative	
Activities	Before 2008 (GH¢)	2008–2012 (GH¢)	Before 2008 (GH¢)	2008–2012 (GH¢)
Total Cost of production in 15 months	8,80.42	1,904.50	1,645.21	3,079.95
Total revenue obtained in 15 months	1,981	3,759	2,703	4,470
Profit obtained in 15 months	1,100	1,854	1,058	1,390
Total cost of production in 3 years	1,064.51	2,173	1,952	3,384.05
Total revenue in 3 years	7,307	13,579	8,994	13,867
Profit in 3 years	6,242.77	11,406	7,042	10,483.20

Source: Fieldwork, 2012

Table 4. Participatory budget for Oman and Enkakyi non-MiDA FBOs.

	Participatory Budget for non-MiDA FBOs			
	Oman Fruits Cooperative Society		Enkakyi Cooperative	
Activities	Before 2008 (GH¢)	2008–2012 (GH¢)	Before 2008 (GH¢)	2008–2012 (GH¢)
Total Cost of production for 15 months	9,22.85	1,693.19	1,446.40	2,311.89
Total revenue obtained in 15 months	2,489.29	2,712	3,278.91	3,860
Profit obtained in 15 months	1,566.45	1,019	1,832.51	1,549
Total cost of production in 3 years	9,82.07	1,545.55	1,534.73	2,483.91
Total revenue obtained in 3 years	7,374.20	7,253.64	8,177.19	7,944.46
Profit obtained in 3 years	6,392.13	5,708.09	6,642.47	5,460.55

Source: Fieldwork, 2012.

transition from smooth cayenne to MD2 (2008 to 2012). The use of the participatory budget was able to highlight this finding which would have otherwise been masked with just the administration of a cross-sectional survey. The participatory nature of the budget enhanced robust findings which to be arrived at in a process that involved disagreements and consensus-building. Inputs from the participatory budget were triangulated with additional key informants' interviews.

5.1. Conclusion and Policy Implications

The use of a participatory budget proved to be a useful method in effectively dealing with challenges associated with estimates biases, the recall of past agricultural inputs and outputs. The use of a participatory budget further chronicled pineapple value chain production activities (innovations) systematically. The participatory budget as a methodological tool assisted in revealing that the MiDA FBOs obtained higher profits in sucker production than the non-MiDA FBOs due to a surge in demand for MD2 suckers. The MiDA FBOs however recorded increases in profit both before and after the inception of the MiDA programme relative to the non-MiDA FBOs who recorded a decline in profit during the period covering 2008 to 2012. Both the MiDA and non-MiDA FBOs obtained similar profits from sales of pineapple fruits after fifteen months. Hence, the participatory budget is a useful tool for assessing the effects of project intervention.

The findings from the participatory budgets showed that the sale of pineapple suckers is an area that received less attention from farmers', researchers, NGOs, business partners and other stakeholders. The use of the participatory budget, however, helped to uncover substantial revenues accrued from sucker production given its participatory nature. This finding is important because the conventional farm management tools have not been able to highlight the economic benefits obtained from sucker production. The conventional farm management tools place much emphasis on the sale of the pineapple fruit harvest to the neglect of sucker production which on the contrary is a valuable input for new entrants. The study recommends that dedicated attention be paid to the economic benefits derived from sucker production. The Department of Agriculture should consider sucker production as an important aspect of the pineapple value chain by offering capacity-building on harnessing the potentials from sucker production. We conclude that the participatory budget is a simple tool to use both as a methodological tool and an instrument for documenting innovations systematically and can be radically integrated into the conventional farm management tools involving cross-sectional data particularly in the global south's agricultural sector that is saddled with record-keeping, estimate bias and recall challenges.

Disclosure statement

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

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