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Abstract

This study analyzed the role played by Fadama II on road development in Adamawa State, Nigeria. The data were obtained from 300 respondents who were randomly selected from Fadama II beneficiaries, non-beneficiaries within Fadama II communities and non-beneficiaries outside Fadama II communities. Based on propensity score matching (PSM) and double difference estimator (DD), the data were analyzed using frequencies, percentages and balancing test (t-test). The results showed that 30% of the roads were funded by Fadama II Project. Most of the roads were constructed and rehabilitated after the establishment of the project. Fadama II roads were found to be important for the beneficiaries' activities. The analysis established that beneficiaries' travel distance, travel time, waiting time and transport fares were reduced relative to non-beneficiaries. Road development has boosted marketing services for both farm and non-farm economic activities. Spill-over effect also manifests in the adjoining communities.

Keywords: *Fadama II*, Road Infrastructure, Effect, Propensity Score Matching, Double-difference, Community-Driven Development

Introduction

Rural infrastructures particularly roads are end product for any rural development program to succeed. The distribution, operation and maintenance are other fundamental prerequisites for a successful rural development. Consequently rural infrastructures constitute the necessary components or ingredients for motivating rural residents to be more productive and achieve relative self-reliance (Estache, 2006). They also aid and enhance the realization of improved rural life. It is quite noticeable that the distribution of rural infrastructures, over time, has not been equitable and spectacular. The gross disparities and total lack of infrastructures in the rural Nigeria are not therefore uncommon features.

Many rural development policies and strategies have failed to achieve their stated objective largely due to the non-recognition and non-provision as well as non - maintenance of the necessary or appropriate infrastructural facilities that need to be put in place overtime and space. Without appropriate provision, operation and maintenance of basic infrastructures therefore, no rural development policy or strategy can stand the test of time. Rural infrastructures are therefore the fundamental ingredients capable of preventing or at least reducing the phenomenal rural urban drift, which is always accompanied with swelling socio economic and political problems

The importance of transportation for any society for instance, need not to be over emphasized as it is very crucial to the functioning of economic, political and socio-cultural life of people, particularly in a society where agriculture is the main source of livelihood like in Adamawa State. Transportation is pertinent for promotion of enhanced agricultural productivity, procurement and distribution of commodities for trade, and for enhancing labour and capital mobility (Galtima, 2005).

Road development is an element of transport that is very crucial in the general process of rural development. It enhances prompt delivery of inputs to farmers and evacuation of produce from farm and to the markets. It links the farmers with the town thereby enhancing the infusion of new cultural traits into the rural areas (Ekong, 2003 and Iraj, 1986). Road development also improves the performance of rural markets making them more competitive to direct benefit of farmers rather than the middlemen.

Road infrastructure investments in developing countries like Nigeria is one of the main contributions of infrastructure development to economic growth operates through its capability to enhance market access and marketing of agricultural products, thus encouraging a structural departure from subsistence-based agriculture

to increased commercialization (IFPRI, 2007; Iheanachu et al. 2007). In an area where these infrastructures are lacking or inefficient, productivity and marketing costs generally rise dramatically and significant decline in investments is experienced (Guasch and Kogan 2001; Jensen 2007; Straub 2007). Expanding the road network could affect both agricultural productivity and agricultural income, as well as open up avenues to other activities for example, by facilitating access to employment opportunities outside the farm as well as establishing rural microenterprises. Adamawa State *Fadama* II has constructed and rehabilitated many of such rural roads (NFDO, 2007). This study investigates the role played by *Fadama II* in road development and its impact on the beneficiaries.

An Overview of Second National *Fadama* Development Project (*Fadama II*)

Second National *Fadama* Development Project (branded as *Fadama-II*) is a follow-up to the First National *Fadama* Development Project (*Fadama-I*), which was implemented during the period 1993-1999. *Fadama-I* focused mainly on crop production and largely ignored support of postproduction activities such as commodity processing, storage and marketing (downstream agricultural sector). The emphasis was on providing boreholes and pumps to crop farmers through simple credit arrangements aimed at boosting cumulative crop output (Nkonya et al. 2008). *Fadama I* worked with *Fadama* User Associations, which the states used mainly to recover loans and to decide on water infrastructure locations.

The design of *Fadama* I did not support rural infrastructure development and did not consider other resource users such as livestock producers, fisher-folk, pastoralists, and hunters, among others. The focus on crop producers contributed to increased conflicts among the users of *fadama* resource. Increased crop production, increased the surplus, but the project did not support post-harvest technology, contributing to reduced crop prices and increased storage losses. And most importantly, it adopted top-down development approach or strategy.

Fadama II was first implemented in 2005 and seeks to address the shortcomings of *Fadama* I by employing paradigm shift from a top-down and supply-driven public sector development program to the community-driven development approach. *Fadama* II also includes other *fadama* resource users that the first project had ignored. *Fadama* II also supports activities and services other than production.

Community-Driven Development Approach of *Fadama* II

Community-Driven Development (CDD) is a development approach that give power to local communities and local governments to participate in the decision making, control, and management of development programs (Dasgupta and Beard, 2007; Dongier *et al.*, 2001). The approach differs from programs and projects that treat beneficiaries as passive aid recipients (Labonne et al., 2007). Most CDD projects focusing on poverty reduction have five main features (Dongier et al., 2001; Dasgupta and Beard, 2007; Labonne *et al*. 2007):

1. *Empowerment of the local communities and local governments:* Community-driven development (CDD) projects are designed to empower local communities and local governments to participate in decision making and management of development programs, to negotiate with institutions and service providers on the planning and implementation of development programs, and to hold services providers accountable.

2. *Demand driven design:* Community-driven development (CDD) projects reflect the needs of local communities and governments, allowing them to determine what types of development activities and resource allocations the project should include to make it effective for them

3. *Social inclusion*: Not all CDD projects involve the poor, women, youth, and other vulnerable groups. For example, CDD projects that target commercially oriented farmers do not include poor subsistence farmers. However, CDD projects that focus on poverty reduction make deliberate efforts to include the poor and vulnerable because they are most prone to poverty.

4. *Collective action*: Because they are community based, CDD projects are designed to be implemented collectively through communities or local governments rather than individuals (Binswanger and Aiyar, 2003; Dasgupta and Beard, 2007). CDD beneficiaries collectively plan and implement project activities, budget, and other resource allocation decisions

5. *Support from external institutions and organizations*: CDD projects receive support from governments and donors. This is one of the main characteristics that differentiate the CDD approach from the methods used by community-based organizations (CBOs), which may not receive external support.

The design of the *Fadama* II project meets all the key features of a CDD project. Consistent with the CDD approach, project activities are centered on *Fadama*

User Groups (FUGs) and *Fadama* Community Associations (FCAs). An FUG comprises *fadama* users with a common economic interest. FCAs are the associations of FUGs operating in a given area. Each FCA designs and oversees the implementation of a Local Development Plan, which is the blueprint of the *Fadama* II's development project in that FCA. The major productive sectors that *Fadama II* supports include crops, livestock, agro-forestry, fishing, and fish farming (fisher-folk). Because the *Fadama* II uses the CDD approach, beneficiaries are given the chance to choose the kind of activities they want to pursue. However, there are some activities that the project does not support, such as activities that could lead to degradation of natural resources or large-scale changes in land use (NFDO, 2005). Under the CDD approach of *Fadama* II, all users of *Fadama* resources are encouraged to develop participatory and socially inclusive local development plans. The project set a target of 50 percent of male and female *Fadama* resource users who benefit from the project-supported activities achieving an increase in average real income by at least 20 percent compared with the baseline.

The project designed the following five components to achieve its targets:

1. *Rural infrastructure investment* to support creation of economic infrastructure and local public goods that would improve the productivity of households using *Fadama* resources. Under this component, beneficiaries are required to pay 10 percent of the costs of constructing rural infrastructure, including rural roads, culverts, market stalls, cold storage, boreholes, and irrigation infrastructure, among others.

2. *Pilot productive asset acquisition support* to enhance the improvements in the productivity and income *Fadama* resource users by facilitating the acquisition of productive assets by individuals or FUGs. Under this component, *Fadama* resource users are required to pay 30 percent of the cost of the productive assets acquired.

3. *Demand-responsive advisory services* to support advisory services that will enable *Fadama* resource users to adopt output-enhancing techniques and more profitable marketing practices in their enterprises

4. *Capacity building* to increase the ability of its beneficiaries to assess their needs, participate in planning, and implement and manage economic activities, and to increase the capacity of the project coordinators to conduct monitoring and evaluation

5. *Conflict resolution* to address the shortcoming of *Fadama* I by increasing the capacity of FUGs to manage conflicts, which were particularly serious and more frequent between pastoralists and crop farmers. More than 98 percent of conflicts among *Fadama* resource users involved pastoralists and farmers (NFDO, 2005). The project set an objective of reducing the number of conflicts by 50 percent by 2010.

Methodology

The study was conducted in Adamawa State, Nigeria. The population of *Adamawa* according to NPC (2006) was estimated at about 3,194,781. However, only the beneficiaries of *Fadama-II* in the state and the neighboring communities were used for this study. There are ten *Fadama-II* benefiting LGAs out of the 21 local government areas that make-up the state namely: *Yola-South, Yola-North, mubi-North, Michika, Gombi, Song, Fufore, Ganye, Guyuk* and *Lamurde* with the total number of the beneficiaries estimated at 52, 366. The study was conducted in five *Fadama-II* projects benefiting LGAs randomly selected at 50 percent. The benefiting LGAs selected include: *Ganye, Mubi-North, Gombi, Guyuk* and *Fufore.*

Sampling procedure

A multi-stage random sampling technique was used for selecting respondents for this study. In each of the randomly selected five LGAs, 50 percent of the FCAs were randomly selected and in each selected FCAs, five households were also selected randomly. A total of 100 households were therefore selected for the entire beneficiaries in this study. Similarly the same numbers of households were selected from non-beneficiaries within and outside *Fadama II* LGAs. In all, a total number of 300 households that matched were then selected for the study. All the economic interest groups (EIGs) such as crop farmers, fisher folks, pastoralists, hunters, widows, processors among others were represented in the sample.

Data Collection

A survey instrument in form of structured questions was employed in this study. The interview schedule was written in English and was interpreted to the respondents in *Hausa* language at the point of interview. The data were collected on the socio-economic characteristics of the respondents, source of funding for roads, importance of Fadama roads, time dimension of roads, access to roads, transportation services, uses of Fadama II, road infrastructure and marketing, and non-farm economic activities.

To obtain data on the impact of the *Fadama* II project on beneficiaries, the sampling frame was divided into three strata: (1) direct project participants, (2) non-project participants living in *Fadama II* communities (3)

non-project participants living outside *Fadama* II LGAs but with socioeconomic and biophysical characteristics comparable to the *Fadama II* communities. The design of this stratification will allow for estimation of the direct impact of *Fadama II*. Comparing *Fadama II* beneficiaries to similar households in similar communities not included in the project provides a better estimate of the total impact of the project on beneficiaries, assuming that spillovers are not affecting households in the communities outside the project.

Baseline data for *Fadama II* were collected using recall information. The project was implemented in September 2005, only slightly above four years before the survey was conducted; therefore, it is expected that respondents would be able to remember the baseline data required for two years before the survey—that is, for the crop years October 2004 to September 2005 (2004–2005) and October 2009 to September 2010 (2009–2010). These marked the years before and after the end of the period of *Fadama II* project in the State. Most households based their responses on memory recall because of the time lag, though not too long (Iheanacho et al, 2007).

Data Analysis

The Propensity Score Matching (PSM) method, which matches project beneficiaries with comparable non-beneficiaries using a propensity score (estimated probability of being included in the project) and the Double-difference (DD) estimator, which compares changes in outcome measures (i.e., change from before to after the project) between project participants and non-participants, rather than simply comparing outcome levels at one point in time, was used in this study to estimate the impact of the project.

The impact of *Fadama II* on road infrastructure was analyzed using matched samples. Simple descriptive statistics including frequencies and percentages were used to estimate the effect of the project. Further testing of the comparability of the selected groups was done using a "balancing test" (Dehejia and Wahba, 2002).This tests for statistical differences in the means of the explanatory variables between the matched groups of *Fadama II* participants and non-participants. The study employed paired t-test statistics because of its suitability and applicability in assessing effects (impact) by comparing responses from beneficiaries and non - beneficiaries of the programs.

Results and Discussions

Sources of Funding for Roads

Majority of the roads as reported by the respondents are supported by state government funds, local governments and Fadama II project. For instance, figure 1 index that larger percentage (42%) of road investments is financed by state governments. Fadama II funded 30% of the road investments reported by respondents, with only 17% investments by local government authorities.

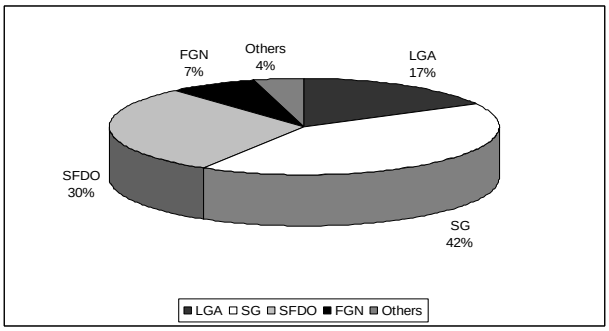

Figure 1: Sources of Funding for Roads Construction and Rehabilitation

Importance of Fadama II Roads

There is a disproportionately high evidence of the importance of the *Fadama II* roads in the area under evaluation. For instance, the usefulness of *the Fadama II* roads is significant and large among the beneficiaries (58.6%) as presented in Table 1. 30% of the respondents in this category did not acknowledge the importance of the *Fadama II* roads. An assessment of the three categories of respondents reporting a *Fadama II* road as useful for their economic activities reveals that there is a strong and immediate evidence of spillover from the infrastructure provision aspect of the project. Table 1 show that a significant proportion of non-beneficiaries use *Fadama II* roads in carrying out income generation activities, especially non-beneficiaries in *Fadama II* LGAs.

Table 1: Respondents Stating *Fadama II* Road is Important for their Productive Activities

Treatment type stating Fadama II road is important	%
Beneficiaries	58.6
Non-beneficiaries within Fadama II LGAs	30.1
Non-beneficiaries outside Fadama II LGAs	9.4

Source: Field work, 2011

Time Dimension of Roads Construction and Rehabilitation

More than 40% of the roads were affirmed to have been constructed before the project began. This is for obvious reason that the authorities (federal and state governments) were providing infrastructures in the rural areas but particularly slow considering the period from 1960 through 2004. *Fadama II* roads had been accessible to the surveyed households only a year after the inception of the project, with most roads available in

2006 and 2007, some years before the time for which the probable effects were measured.

Table 2: Reported Year in which FII Roads were Constructed or Rehabilitated

	Roads	
Year	**Number**	**Percent**
Between 1960 and 2004	22	40.8
2005	1	1.6
2006	15	24.2
2007	11	21.3
2008	7	8.8
2009	2	3.2
2010	0	0.0
Total	56	100.0

Most of the roads were constructed and rehabilitated after the establishment of *Fadama II* project (Table 1). Although not all the achievement can be attributed to the operations of the project, it may perhaps be stated that the effort of *Fadama II* has gingered other service providers into action. This is particularly clear as no road construction and rehabilitation was recorded in 2010 just a year after life span of the project (Table 1).

Access to Roads

The impact of the project on access to roads is assessed using three measures. As shown in Table 3, in all three cases, the sign of the estimate suggests that access to road infrastructure improved as a result of the *Fadama II* project: the distance to the nearest all-weather road, the distance to town, and the time it takes to travel to the nearest road by motor vehicle was reduced. The comparability test for difference between the treated groups (beneficiaries) and the control groups (non-beneficiaries) shows that the results are statistically significant at p= 0.05 for two of the three measures. The result is statistically significant except for the change in mean distance to road (Table 3).

Table 3: Project Impact on Access to Road Infrastructure

Outcome Variable	Treated	Control	T-test	Std.Err	P-value
Change in mean dist. to road (km)	-0.597	-0.242	-0.559	0.635	0.5781
Change in mean dist. to town (km)	-0.774	0.500	-3.878	0.329	0.0002**
Change in mean travel time by motor vehicle (min)	-22.823	1.919	-15.404	1.606	0.0000**

Source: Field Work, 2011

Transportation Services

The average length of time individuals waits for motor vehicle and cost of transportation have significantly reduced as a result of the intervention. For example, Table 4 shows that the waiting time for vehicle transportation fell by 54% on average, with the improvement in transportation availability more than twice as large in the local government areas (LGAs) in which the *Fadama II* project was operating. It was further discovered that the percentage change in waiting time was also higher for non-beneficiaries in *Fadama II* local government (LGAs) compared to non-beneficiaries outside *Fadama II* LGAs, suggesting spillover effects of road infrastructure investment on access to transportation services. These results provide tentative facts that by providing infrastructure, Fadama II may have contributed to reducing transportation costs (or more accurately, to mitigating their increase).

Table 4: Average Time Waiting For Motor Vehicle Transportation

Treatment Type	Average wait time (minutes)		% change
	2004	2010	
FII beneficiaries	51.61	23.63	-54.2%
Non-beneficiaries within	42.63	34.32	-19.5%
Non-beneficiaries Outside	42.52	43.06	1.3%

Table 5 presents the matching estimation results for the impact of the project on transportation services. The result shows that the provision of roads resulted in improved access to transportation services, in terms of both quantity and costs. The statistical test for difference (balancing test) indicates that the result is significant for all the three indicators (waiting time, cost of transporting load and change in fare to nearest town) of transportation services at p = 0.05.

Table 5: The Impact of *Fadama II* on Transportation Services

Outcome Variable	Treated	Control	T-test	Std.Er	Pvalue
Change in mean time waiting for transportation (mins)	-27.984	0.548	-9.519	2.9975	0.000**
Change in mean cost of transporting load on truck	305.242	573.709	-5.377	49.932	0.000**
Change in mean fare to nearest urban area	15.161	21.581	-2.414	2.659	0.017**

Uses of Road Infrastructure

Figures 2 and 3 show the self-reported primary uses of roads that respondents accessed. In view of both project-supported and other roads, Figure 2 shows that, among the uses associated with productive activities, improved ability to access farmlands is the single largest use (24%), followed by the transport of agricultural inputs (20%), transportation of agricultural output (18%). A smaller proportion of the respondents reflect on being able to transport "people" (e.g., to get themselves to places of employment) as the main use of the road.

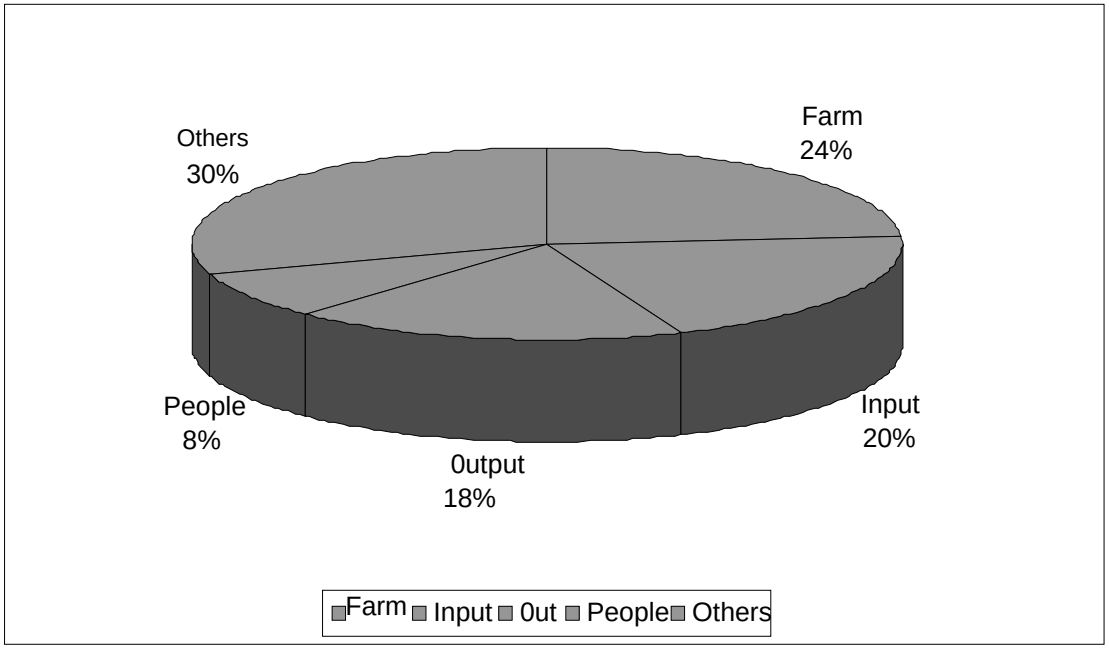

Figure 2: Use of All-weather Roads

The same analysis limited to *Fadama II* roads is offered in Figure 3. The figure shows that the extent of use to access farmland and to transport people is similar to the overall average. What is remarkable however is the percentage of individuals using *Fadama II* roads for agricultural input and output transportation was much larger than was the case for all-weather roads.

Overall, the use of roads for productive purposes was larger by about 66% points. This is consistent with the project's goal of improving access to public infrastructure and thereby improves production and marketing activities. An efficient rural road system ensures cheap and fast evacuation of agricultural produce from rural to urban areas for farmers to enjoy better price incentives. More so, it also facilitates easy access to farm and transportation of farm inputs and humans. Galtima (2005) in his findings considers transportation as pertinent for promotion of enhanced agricultural productivity, procurement and distribution of commodity for trade, and for enhancing labor capital mobility

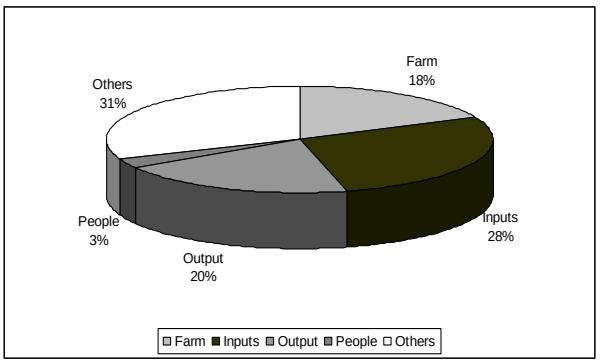

Figure 3: Use of Fadama II Roads

Road Infrastructure and Marketing

Table 6 show the share of agricultural production sold on the market in 2004 and 2010. The share of production sold on the market increased from 40 percent to 70% for *Fadama II* households, which represents a 30% change in this share. It is also observed that the marketed share increased over this period of *Fadama II* operations for all respondents. However, higher increase

is experienced more among the project beneficiaries than the non-beneficiaries alike. The non-beneficiaries within *Fadama II* LGAs experienced increase from 40% to 55% which represent an increase of only 15% compared to the beneficiaries. The non-beneficiaries outside *Fadama II* communities had increase of only 2%, indicating that spill-over effect has occurred.

Table 6: Share of Total Production Marketed in 2004 and 2010

Treatment Type	2004	2010
Fadama II Beneficiaries	40%	70%
Non Beneficiaries within *Fadama II* LGAs	40%	55%
Non Beneficiaries outside *Fadama II* LGAs	25%	27%

In general, this findings suggests that current effort to promote community-driven development (CDD) projects through farmer groups are likely to increase access to infrastructure and marketing services (Nkonya et al, 2010).

Nonfarm Economic Activities

The matching estimation results for the impact of the project on nonfarm economic activities as shown in Table 7 indicates that the provision of roads in the study area has enhanced and diversified microenterprises.

Table 7: Impact of *Fadama II* on Nonfarm Economic Activities

Treatment Type	Mean	t-test	Std. Err	P-value
Beneficiaries	59824.1(122018.56)			
All non-beneficiaries	49895.5(19138.94)	3.713	16161.75	0.008**

The table 7 also shows an evidence of statistically significant effects of the *Fadama II* project on nonfarm activities, as measured by changes in the level of nonfarm income or participation in nonfarm activities. In contrast to all other outcome variables previously considered, expansion of nonfarm economic activities and diversification are changes that occur particularly remarkably significant at p = 0.05 statistical test for difference between the beneficiaries and non-beneficiaries of the project, after improved access to roads and transportation has been established.

Conclusion

The findings suggest that reasonable number of roads were funded by Fadama II project. There is also evidence that most of the roads were constructed and rehabilitated after the establishment of *Fadama II* project.

Using propensity score matching and double difference methods to control for project placement and self-selection biases, the study established that *Fadama II* reduced beneficiaries' distance and travel time to the nearest town and reduced the waiting time and fares for transportation services, relative to non – beneficiary households in *Fadama II* LGAs due to road construction and rehabilitation. This implies that more time and funds were now available for farm production. Overall, the finding suggests that there is significant positive impact of the Fadama II on the road rehabilitation and construction in participating communities. Spill-over effects also manifests in the adjourning communities as the use of the infrastructure, were not limited to only the project participant.

In general, this findings suggests that current effort to promote community-driven development (CDD) projects through farmer groups are likely to increase access to infrastructure and marketing services (Nkonya et al, 2010). There is also some evidence that participatory projects create effective community infrastructure and improve welfare outcomes (Mansuri and Rao, 2004). *Fadama II* is all-embracing in its activities of empowering the communities to take charge of their development agenda (CDD approach) ranging from farm and nonfarm income generating activities (Kudi et al. 2008; NFDP, 2003).

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