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Evaluating effectiveness and constraints of private sector agricultural extension services of the Green River Project in Imo and Rivers States, Nigeria

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Background: Oil exploration operations decreased the cultivable lands of rural people in the study area, leading to the establishment of the Green River Project (GRP). This study assessed the effectiveness and constraints of private sector extension services of GRP in Imo and Rivers States, Nigeria.

Objectives: To analyse the roles and effectiveness of, as well as constraints to, the GRP in the area.

Method: A multistage sampling technique was used to select 120 respondents. Descriptive statistics, factor analysis, chi square and *t*-test were used to analyse the data.

Results: Roles of GRP in farming technologies dissemination included training of farmers on fish pond construction technique and maintenance of good pH levels. There was significant improvement in standard of living ($X^2 = 15.7$; $p \leq 0.05$) and size of production ($t = 6.398$; $p \leq 0.05$) of the respondents after participation. In terms of the effectiveness of private sector deliveries on public policies, the programme had effect on beneficiaries' access to credit, education of wards and poverty reduction. But it is worthy to note that the observed changes may not have been solely caused by the GRP, given that there could be many other factors affecting fish farming, either positively or negatively. Serious implementation constraints to effective performance of GRP included organisational, input and sustainability constraints.

Conclusion: It was recommended that there should be timely provision of sufficient inputs to farmers and measures to improve organisation of private sector extension services in the area in order to enhance development.

Introduction

The importance of extension services in promoting agricultural and/or rural development cannot be overemphasised. Agricultural extension services help to boost the standard of living of rural farmers. Extension helps in empowering all members of the farm households to ensure holistic development (Sinkaiye 2005). It brings about changes in farmers' attitude, knowledge and skills through education and communication. Its role includes: dissemination of information, building capacity of farmers through the use of a variety of communication methods and helping farmers make informed decisions. However, agricultural extension in Nigeria is faced with myriad problems which militate against the optimisation of its potential. Some of the constraints include inadequacy and instability of funding, poor logistic support for field staff, use of poorly-trained personnel at local level, poor implementation of programmes, poor infrastructures and inadequate access to credit, personnel and database. These and other problems exposed the country to numerous problems, including hunger and poverty. In addition to this, a significant proportion of the population is food insecure. Recently, the Nigerian Bureau of Statistics reported that about 100 million Nigerians are living below poverty level (Ladeinde 2012). Agricultural projects and their extension services can help to reduce these problems if properly planned and implemented.

Different agricultural programmes with their extension service component have been planned and implemented to boost agricultural production in Nigeria. There are various national and international agencies whose aims are to reduce poverty and improve agricultural production and socioeconomic status of Nigerians through implementation of agricultural projects. The various programmes initiated in Nigeria include: the National Accelerated Food Production Programme (NAFPP), River-Basin Development Authority (RBDA), Agricultural Credit Guarantee Scheme (ACGS), National Programme on Food Security (NPFS), Fadama projects, Directorate for Food, Road and Rural Infrastructure (DFFRI) and National Agricultural Insurance

Corporation (NAIC) (Ogundiya 2010). The Root and Tuber Expansion Programme (RTEP), and Community Based Natural Resource Management Programme (CBNRMP) were also initiated and funded by International Fund for Agricultural Development (IFAD), federal, state and local governments and benefiting communities. There were also projects initiated to improve fish production in Nigeria (Tawari & Davies 2009). Agricultural extension services and fisheries projects were implemented by multinational oil companies operating in the country. Oil exploration operations of these companies decreased the cultivable lands of rural people. This led to establishment of extension services to help improve fish production since most of the rural dwellers were fish farmers. These include extension services provided by: the Green River Project (GRP) of Nigerian Agip oil company (NAOC) limited; Shell Community Development Project (SCDP) of Shell Petroleum Development Company (SPDC); and the Agricultural Unit of Elf Community Development Programme (Elf). Other agencies involved in fisheries programmes include Integrated Rural Fisheries Development Project (IRFD), IFAD and Inshore Fisheries Development Project (IFDP) (Alfred-Ockiya 2000). These agencies adopt a comprehensive extension programme involving the formulation of extension messages and the utilisation of modern technologies to improve fish and agricultural production. However, fish production in Nigeria has not been adequate for the populace. In order to improve adoption of technologies disseminated by extension agencies, it is important to make the content more relevant to farmers. It is also important to develop a sustainable financing option, use well trained and adequate staff, and use participatory extension approach under stable policy and sustainable institutional arrangement (Koyenikan 2008). Most importantly, there is a need for proper and stable funding of extension services. This made different private sector involvement in financing agricultural services in Nigeria vital.

The Green River Project (GRP), which is a private sector extension service, was established in 1987 by the Eni Corporation, NAOC, Phillips Petroleum and the Nigerian National Petroleum Company (GRP 2001). The fish farm development component of the project started its operations in 1999 (GRP 2001). GRP operates in areas where NAOC has its oil production sites which include Imo, Delta, Bayelsa, and Rivers States. Oil deposits in the state resulted to the presence of the NAOC and its GRP. GRP areas are essentially rural with farming and fishing as the major economic activities. Farming in the area is based on mixed cropping and rotational fallow while fishing is carried out in the vast swamp areas (GRP 2001). The soils are mostly alluvial, with high contamination due to pollution, and the vegetation consists mainly of mangrove and rain forest. The fish farmers are either domesticated or wild fish farmers. The domesticated fish farmers include farmers that use rubber tanks, concrete ponds and larger earthen pond. Fish species mostly farmed by domestic fish farmers include tilapia and catfish. The wild fishers catch fish from the surrounding lakes and rivers. The aim of the project is to: increase agricultural productivity and to prevent further deterioration of the soil through the use of better farming techniques; improve the income of farmers and make them more self-sufficient; and increase the standard of living of rural families so as to reduce the flow of migrants to the towns. (GRP 2005). GRP as a modular integrated rural development programme is involved in the following activities with her technical partners, among others: a teaching programme using demonstration plots to train farmers on new agricultural technologies; creation of cooperatives and associations in order to ensure that technical innovations are received, applied, managed and promoted in the possible way by the target poor resource farmers; facilitation of access to microcredit schemes and marketing opportunities; transfer of appropriate technology to serve as a landmark for future projects and aquaculture and fish farming development (GRP 2005).

For the past decade, GRP and other private sectors extension services have implemented fish farming projects to enhance fish production and standard of living of beneficiary fish farmers. However, according to Amaniyie (2006), agriculture which is the major occupation and main source of income to rural indigenes of Imo and River States was negatively affected by the operation of oil exploratory companies. Hence, private sector extension services of oil exploration companies in the area were initiated as important tools to improve fish production in these communities. Technologies disseminated to the farmers over many years, in line with their objectives include fish farm management technologies, feeding techniques, fish culture management techniques, pond water quality and quantity management and liming techniques. If these fishery technologies are properly disseminated by GRP and adopted by the fish farmers, there ought to be positive effects in the productions of the fish farmers. However, despite the activities of GRP in Niger Delta, Nnodim and Isife (2004) reported that many farmlands, economic crops and trees and fishing waters in the region were barren. The rural people live with untold hardship, poverty and poor socioeconomic standing (Nlerum, Isife & Albert 2012; Wangbu 2005). This made it necessary to ascertain the roles, effectiveness and constraints of private sector extension services of multinational oil companies in the area using GRP as a case study. Therefore, the questions were: what are the roles of GRP in the area as perceived by the farmers? What are the effects and effectiveness of GRP extension services on fish farmers as at the year 2012? And what factors constrain effective implementation of these roles?

Hence, the purpose of this study was to assess roles, effectiveness and constraints of private sector extension services in Imo and Rivers States, Nigeria. Specifically, the study sought to:

(1) assess the roles of GRP in improving fish farming, as perceived by farmers in the area;
(2) determine the effectiveness of GRP extension services on fish farmers as at the year 2012; and
(3) ascertain constraints to effective performance of private sector delivery of GRP.

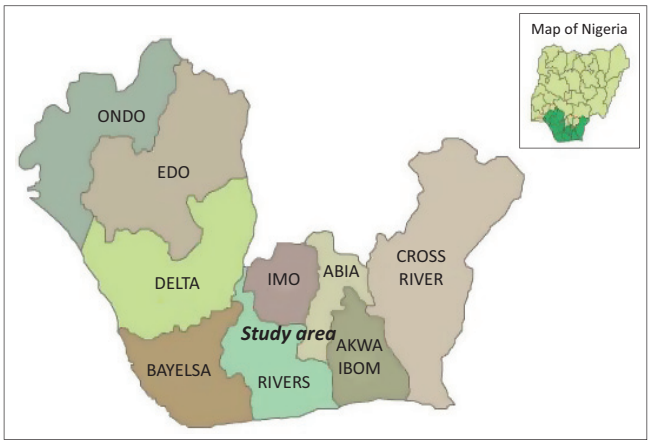
Research method and design

Setting

The study was carried out in Imo and Rivers States, Nigeria (represented in Figure 1). Rivers State lies between longitude 6°50'E and 7°00'E and Latitude 4°45'N and 5°70'N. The inland part of Rivers State consists of tropical rainforest towards the coast. The mean monthly temperature is in the range of 25–28°C and the mean annual rainfall ranges from 2032 mm in-land area to 3048 mm towards the coast (Niger Delta Regional Development Master Plan [NDRDMP] 2006). River State is bounded on the South by the Atlantic Ocean, to the North by Imo and Abia States, to the east by Akwa Ibom State and to the west by Bayelsa and Delta States (NDRDMP 2006). Imo State lies within latitudes 4°45'N and 7°15'N, and longitude 6°50'E and 7°25'E, with an area of around 5100 km^2 (http://en.wikipedia.org/wiki/Imo_State). It is bordered by Abia State on the East, by the River, Niger and Delta State on the west, by Anambra State to the north and Rivers State to the south (NDRDMP 2006).

Population and sampling technique

All fish farmers and extension personnel in GRP constituted the population for the study. Multistage sampling procedure was used to select the sample. In the first stage, simple random sampling technique was used to select two States (Imo and Rivers States) out of the four States (Imo, Delta, Rivers and Bayelsa) where GRP operates. In Rivers State, GRP operates in Ogba/Ndoni/Egbema LGA. The LGA is divided into two zones (Ogba/Ndoni zone and Egbema/Oguta zone) by NAOC-GRP. In the second stage, the two zones were purposively used in order to get adequate number of fish farmers. In the third stage, two town communities were selected from each zone. In Egbema/Oguta zone, two town communities (Mgbede and Okwuzi) were selected from the four communities (Mgbede, Okwuzi, Ebocha, and Aggah) that formed the zone using a simple random sampling technique. Two town communities (Obrikom and Omoku) were also purposively selected from the nine town communities (Omoku, Obrikom, Obor, Idu, Agwe, Ase-Azaga, Isukwa, Odugiri and Obiofu) that made up the Ogba/Ndoni zone in order to use areas whose roads were not destroyed by floods in year 2012. The GRP personnel were asked to make a list of the beneficiary fish farmers from which 20 beneficiary fish farmers were selected from each town community (Obrikom and Omoku) and 10 beneficiary fish farmers from Mgbede and Okwuzi, using a purposive sampling technique for each community because the sample was drawn from the list of farmers reached by GRP. This gave a total of 60 fish farmers in Rivers State.



Source: http://ndlink.org/wp-content/uploads/2014/01/niger-delta-map.jpg

FIGURE 1: Map of Nigeria showing the study area.

In Imo State, two local governments (Ohaji/Egbema and Oguta LGA) in Egbema/Oguta zone were used. Three town communities (Etekuru [in Ohaji LGA] and Ezi-Orsu and Oguta [in Oguta LGA]) out of seven town communities in the zone (Etekuru, Ezi-Orsu, Afiafor, Akrri, Enigbo-Abatu, Orsu-Obodo and Oguta) were selected from the two LGAs using a simple random sampling technique. A list of beneficiary fish farmers in these town communities was collected from the GRP personnel, from which 20 fish farmers were selected using a purposive sampling technique (because the sample was drawn from the list of farmers reached by GRP) making a total of 60 farmers in Imo State.

In the last stage, 20 GRP personnel were purposively selected based on their involvement in the fishery programme. Hence, a total of 140 respondents (120 fish farmers and 20 GRP personnel) was the sample for the study. This was because of the limited resources available for the study.

Data collection instruments and process

Data were collected from GRP fish farmers through the use of an interview schedule, administered by research assistants. A pre-test was carried out to ascertain validity of the instrument. The survey was carried out in 2013 and the same group of farmers was used for the study to assess the effects of GRP before and after their participation. To ascertain their socioeconomic conditions before 1999, they were asked to think and recall their conditions at that time. This implies that the differences in their socioeconomic conditions is majorly, but not solely, because of their participation in GRP.

To assess the roles of GRP in improving fish farming in the area, a list of fish farming technologies was disseminated and other activities were obtained from GRP personnel, such as training on techniques of site selection, feed formulation and fish seed multiplication. These were provided for respondents to tick either 'yes' or 'no' against each role based on their perception. To determine the effects of private sector extension services and deliveries of GRP on fish farming in the area, socioeconomic conditions of the fish farmers were measured and compared, using a before and after evaluation model. Variables that were measured include access to credit, education of wards and poverty reduction before and after participation in the project. Significant differences in these socioeconomic conditions (before [in the year 1999] and after participation [in the year 2012]) were used to indicate effectiveness of extension service of GRP. To ascertain constraints to effective performance of the

GRP extension services (objective five), a list of possible project implementation constraints was provided. The respondents (extension agents) were asked to rate the level of seriousness of the constraints on a three-point Likert type scale of 'very serious', 'serious' and 'not a constraint at all'. Values of 2, 1 and 0 were assigned to the options, respectively, and a cut-off point of 1.0 was used to determine serious constraints to effective performance of the extension services of GRP.

Data analysis

Data were analysed using percentages and *t*-test to assess the roles and effectiveness of GRP. Data were subjected to explanatory factor analysis procedure, and principal factor model with varimax rotation was used in grouping constraint variables into major constraint factors.

Results and discussion

Roles of GRP in improving fish farming in the area

Table 1 shows that majority of the fish farmers indicated that roles of GRP includes distribution of fish farming tools such as wheelbarrows (88.0%), fishing nets (70.0%) and credit facilities (89.0%). The majority of the fish farmers indicated that the roles included dissemination of fish farm management technologies such as: training on the need to form cooperative societies (95.0%); training on good record-keeping technique (89.2%); and proper site selection, considering source of good water (81.7%) and pond construction size of 75 cm to 2 m deep (84.2%). On the contrary, a small proportion (37.5%) of the respondents indicated that training on use and supply of harvesting tools were part of the roles of GRP. According to Tawari and Davies (2009), programmes on pond management techniques had high participation from respondents. This may be due to the fact that most fish farmers indicated that they started managing their ponds properly with assistance from GRP. Also, 45% of the respondents indicated that GRP distributed harvesting tools. This is in line with the finding of Tawari and Davies (2009), who noted that fishermen were not encouraged or assisted with the provision of fishing

TABLE 1: Percentage distribution of respondents according to roles of GRP in improving fish farming.

Roles†/sensitisation/training activities	Percentage (%) of fish farmers
Use of different sizes of feed (eg. 0.5 mm at first week)	97.5
Use of good feed (eg. Cupen)	97.5
Changing of bad water	95.8
Training farmers on the need to form cooperatives societies	95.0
Training of farmers on grading techniques	95.0
Training on use of correct quantity of feed	94.2
Training on stocking techniques like avoiding overstocking	94.2
Trainings on selection of good fish species like tilapia and catfish	94.2
Water testing to ensure quality standard	94.2
Sensitisations to maintain proper water quantity	94.2
Good record-keeping technique	89.2
Provision of credit for farmers	89.0
Distribution of fish farming tools such as wheel barrow	88.0
Maintenance of proper water temperature of 20–30°C	86.7
Fish harvesting techniques (proper time 4 months and weight 1 kg)	85.8
Maintenance of proper oxygen level of 5.0–9.5 mg/L	85.8
Maintenance of good pH level of 6.5–8.55	85.0
Pond construction size	83.3
Helping farmers to obtain credit	83.3
Provision of fingerling like tilapia and catfish	82.5
Use of liming materials to buffer water pH	82.5
Proper site selection considering source of good water	81.7
Use of liming to reduce muddy water	79.2
Distribution of fishing nets	70.0
Proper fertilisation of pond	70.0
Type of liming material to use ($Ca(OH)_2$, CaO, wood ash)	69.2
Liming to fertilise pond	64.2
Training on medication and disease control	61.7
Training farmers to produce locally-made feed	50.0
Provision of good quality floating feed (eg. cupen, zigla and vital)	50.0
Provision of harvesting tools like fish gears	45.0
Use of ground limestone at the rate of 1104 kg/ha	40.0
Use of quicklime of 200 kg/ha	36.7
Use of hydrated lime of 114 kg/ha	35.8
Use of agricultural lime at the rate of 2270 kg/ha	35.0
Fish seed multiplication technique	32.5

Source: Field survey, 2013

†, multiple responses.

implements by the agencies in Niger Delta States. The implication of these findings is that since the majority received the fish farm management technologies, they should be able to manage their fish ponds properly. This will enhance their productivity and positively improve the impact of GRP extension services on the farmers.

The majority of the farmers indicated training on fish feeding techniques as part of the roles of GRP in improving fish farming. The fish feeding techniques include: use of different sizes of feeds, like 0.5 mm at the first week (97.5%); use of good feed, such as cupen (97.5%); and use of the correct quantity of feed (94.2%). Half (50%) of the respondents included training on production of locally-made feed as one of the roles. In addition, half (50%) of the fish farmers indicated that GRP distributed good quality feed. This is in line with Nlerum (2013), who found that most of the fish farmers were trained on the right feeding techniques. The findings also explain why only a few fish farmers compounded their fish feed locally in the area, since half of the farmers received trainings on production of feed.

Most of the GRP fish farmers indicated that GRP provided fish culture management technologies such as: grading techniques (95.0%); stocking techniques (94.2%); trainings on selection of good fish species, such as tilapia and catfish (94.2%); fish harvesting techniques (proper time of 4 months and at weight of 1 kg) (85.8%); proper fertilisation of ponds (70.0%); helping farmers to obtain credit (83.3%); and provision of fingerlings, such as tilapia and catfish (82.5%). Additionally, 61.7% of the respondents indicated that GRP gave training on vaccination and disease control, while 32.5% of the farmers agreed that there was training on fish seed multiplication techniques. This agrees with Tawari and Davies (2009), who stated that fish culture management, for example, grading and sorting, had the highest percentage of farmers that fully benefitted from and practised the technologies. On the contrary, seed multiplication centres are not available in high numbers in the Niger Delta and act as a limiting factor for the growth of fish culture and aquaculture. The implication of the finding is that the farmers will be able to adopt these important fish farming technologies once trained.

A large proportion of the respondents agreed that the water quality and quantity management technologies were disseminated by GRP. The technologies include: changing of bad water (95.8%); reducing and topping of water to maintain proper water quantity (94.2%); water testing to ensure quality standard (94.2%); maintenance of proper water temperature of 20–30°C (86.7%); maintenance of proper oxygen levels of 5.0–9.5 mg/L (85.8%); and maintenance of good pH levels of 6.5–8.55 (85.0%). This agrees with the findings of Tawari and Davies (2009), which stated that the GRP fish farming unit helps the farmers to maintain their pond water quality. The implication is that the fish will not suffer from diseases, as this will reduce the percentage of mortality in the ponds.

The majority of the fish farmers were trained on liming techniques. These techniques include: use of liming materials to buffer water pH (82.5%); use of liming to reduce muddy water (79.2%); liming to fertilise ponds (64.2%); and sensitisation on the type of liming material to use, for example, hydrated lime ($Ca(OH)_2$), quick lime (CaO) and wood ash (69.2%). A small proportion of the farmers received technical advice from GRP personnel on: use of ground limestone at the rate of 1104 kg/ha (40.0%), use of $Ca(OH)_2$ of 114 kg/ha (35.8%), use of agricultural lime at the rate of 2270 kg/ha (35.0%), and use of quicklime of 200 kg/ha (36.7%). Most benefitted from training on the need for use of the liming technique but only a few benefitted with regard to use of other liming techniques. This supports the findings of Nlerum (2013), in which the majority of the farmers do not use liming.

Effects of private sector extension services deliveries of GRP on fish farming in the area

Table 2a and Table 2b show that the mean volume of credit applied for and volume obtained after participation in GRP were N19 825.00 and N19 708.33, respectively, while the respondents did not apply for credit before participation in GRP. It also indicates that there was significant difference (t = 10.416 and 10.392; $p \leq 0.05$) in the mean scores. GRP extension services had a positive effect on the volume of credit applied for and the volume obtained by the respondents.

The average incomes earned from sale of fish by the respondents before and after participation in GRP were N245 970.83 and N427 965.00, respectively. There was a significant difference in the average incomes (t = 7.390; $p \leq 0.05$). Since the quantity of fishes stocked and harvested after participation in GRP differed from the quantity stocked

TABLE 2a: Effects of private sector extension services deliveries of GRP on fish farming in the area.

Variable	Before participation (1999) (M)	After participation (2012) (M)	*t*-value	*P*-value
Total number of fingerlings stocked	1033.33	7841.67	6.398*	0.005*
Quantity of fish harvested (Kg)	807.25	6919.67	6.279*	0.050*
Income from fish farming (N)	24 5970.83	42 7965.00	7.390*	0.036*
Fishing net	1.00	1.00	6.858	0.100
Wheelbarrows	0.00	2.00	7.055	0.290*
Volume of credit				
Volume of credit applied for	0.00	19 825.00	10.416*	0.050*
Volume of credit granted	0.00	19 708.33	10.392*	0.046*

Source: Field survey, 2013

*, significant; M, mean.

TABLE 2b: Effects of private sector extension services deliveries of GRP on fish farming in the area.

Variable	Before participation (1999)	After participation (2012)	X^2 Value	Asymp Sig (2-sided)
Perceived standard of living of family				
Worse than others	19.2	0.8	15.7*	0.003*
As good as others	78.3	52.5		
Better than others	2.5	46.7		
Degree of ease of access to credit facilities				
Not easy	69.2	31.7	41.7*	0.000*
Easy	30.0	44.2		
Very easy	0.8	24.2		
Degree of ease of training of wards				
Not easy	50.0	10.8	17.5*	0.002*
Easy	49.2	64.2		
Very easy	0.8	25.0		

Source: Field survey, 2013
*, significant.

and harvested before participation, the income of the respondents was also statistically different before and after participation. This shows that the extension services of GRP had a positive effect on the respondents' income.

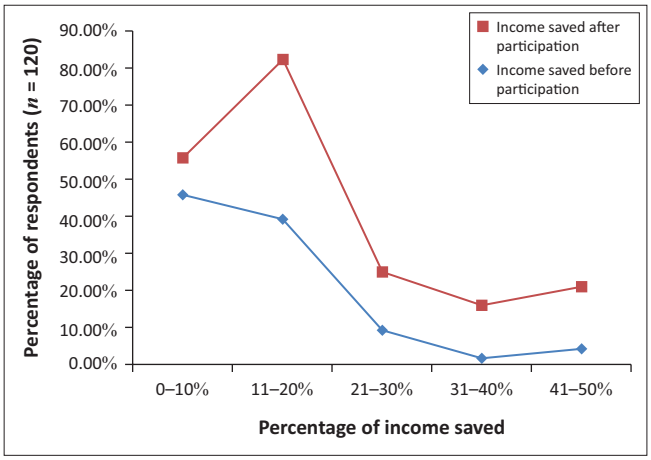
The average fingerlings stocked by the farmers were 1033.33 before and 7841.67 after participation. The result shows that there was significant difference ($t = 6.398$; $p \leq 0.05$) between the average quantity of fingerlings stocked by respondents before and after their participation. This agrees with Nlerum *et al*. (2012), who found that GRP had a positive effect on the number of fish ponds stocked by the GRP beneficiaries, as the GRP fish farmers benefitted from the fingerlings provided by GRP.

The average quantities of fish harvested by the farmers before (1999) and after participation (2012) in GRP were 807.25 kg and 6919.67 kg, respectively. There was significant difference ($t = 6.279$; $p \leq 0.05$) in the mean scores. This agrees with Adewuyi *et al*. (2010), who stated that improved technologies had a positive impact on the farm output beneficiaries. The field study also revealed that most of the respondents who used the GRP fish farming technologies did not encounter mortality, even though they practised little or no medication of their stocked fish. This resulted in a large harvest, indicating that GRP has an impact on the quantity of fish harvested.

The average numbers of fishing nets owned by respondents, before (1999) and after participation (2012) in GRP, were 1.00 and 1.00, respectively. There was no significant difference ($t = 6.858$; $p \leq 0.05$) in the mean scores. This GRP extension services had no effect on the number of fishing nets owned by the respondents.

The average numbers of wheelbarrows owned by the respondents before and after participation were 0.00 and 2.00, respectively. It also shows that there was significant difference in the mean scores ($t = 7.055$; $p \leq 0.05$), which implies that there was an effect of GRP on the number of wheelbarrows owned by the respondents.

Entries in Figure 2 show the distribution of the proportion of income saved before and after participation in GRP.



Source: Field survey, 2013

FIGURE 2: Effects of extension service of GRP on proportion of income saved by respondents before and after participation in GRP.

There was significant difference ($X^2 = 224.3$; $p \leq 0.05$) in proportion of income saved by the respondents before and after participation. In addition, 4.2% saved 41% of their income before participation, while 16.7% saved 50% of their income after participating in GRP. This shows that they saved more after participating in GRP, which is evidence that GRP extension services had an effect on the proportion of income saved by the respondents.

Half of the respondents (50.0%), 49.2% and 0.8% of the farmers indicated that training of their wards in school before participation in GRP were not easy, easy and very easy, respectively while 10.8%, 64.2% and 25.0% of the farmers indicated that training of their wards after participation in GRP were not easy, easy and very easy, respectively. There was significant difference ($X^2 = 17.5$; $p \leq 0.05$) in the degree of ease of training of wards. This implies that GRP extension services had a positive effect on the respondents' degree of ease of training of wards in school, which could be due to the fact that 0.8% of the respondents found it very easy to train their wards in school before participation, whereas 25.0% found it easy after participation.

Results show that 69.2% of the farmers indicated that access to credit *before* participation in GRP was not easy, 30.0% easy

and 0.8% very easy, while 31.7% of the farmers indicated that access to credit *after* participation in GRP was not easy, 44.2% easy and 24.2% very easy. This implies that there was a significant difference ($X^2 = 41.7$; $p \leq 0.05$) in the degree of ease of access to credit. This is evidence that GRP extension services had a positive effect on the respondents' degree of ease of access to credit. It could be attributed to the fact that 0.8% and 24.2% of the respondents found it very easy to access credit facilities before and after participation, respectively.

The results in Table 2a and Table 2b reveal that 19.2% indicated that their perceived standard of living was worse than others in the society, 78.3% as good as others and 2.5% better than others, before participation. On the contrary, results from after participation showed that 0.8% indicated that their families' perceived standard of living was worse than others in the society, 52.5% as good as others and 46.7% better than others. Also, 2.5% and 46.7% of the respondents indicated that their families had a better standard of living than other families in the area before and after participation, respectively. There was significant difference ($X^2 = 15.7$; $p \leq 0.05$) in the standard of living of the respondents' families. Hence, GRP extension services had positive effect on the standard of living of the farmers' families.

Constraints to effective performance of private sector deliveries of GRP

Data in Table 3 show the result of the varimax rotated component matrix indicating the extracted factors based on the perceived constraints to adoption of disseminated technologies. Three major constraints were extracted. Variables with a loading of 0.40 and above at 10% overlapping variance were used in naming the constraints. Factors 1, 2 and 3 were named 'organisational constraint', 'input-related constraints' and 'sustainability constraints', respectively.

Organisational constraints include constraining variables such as:

- limited information on improved technology (0.663)
- inadequate induction training of extension personnel (0.798)
- unnecessary bureaucracy (0.608)
- distrust of extension personnel by fish farmers (0.883)
- limited number of extension personnel (0.868), and
- insufficient means of mobility (0.737).

This is in line with the finding of Nlerum (2013), in which inability of the GRP contact person to teach the technology properly was the militating problem of beneficiaries of the GRP. The inability of the contact person to teach the technology may negatively affect the impact of the project on the farmers.

Input-related constraints included:

- inadequate funding (0.898)
- technical and educational competency of extension agents (0.549)
- delay in input delivery (0.809)
- difficulty in use of improved communication gadgets (0.477)
- land acquisition problems among farmers (0.661)
- unviable/insufficient fingerlings (0.857)
- lack of brood stock (0.540)
- low hatchability of fingerlings (0.476), and
- limited information on improved technology (0.663).

TABLE 3: Constraints to effective performance of private sector deliveries of GRP.

Variables	Factors		
	Organisation constraints	Input-related constraints	Sustainability constraints
Limited number of extension personnel	0.868	0.314	0.130
Inadequate funding	0.238	0.898	0.162
Insufficient means of mobility	0.737	0.261	0.238
Redundancy of extension personnel	0.163	0.115	0.898
Technical and educational competency of extension agents	0.242	0.549	-0.497
Difficulty in identifying training needs of target audience	0.385	0.342	0.580
Low adoption of technology	-0.170	0.115	0.705
Distrust of extension personnel by fish farmers	0.883	0.263	-0.164
Delay in input delivery	0.189	0.809	0.238
Unnecessary bureaucracy	0.608	0.587	0.385
Inadequate induction training of extension personnel	0.798	0.382	0.385
Difficulty in use of improved communication gadgets	-0.273	0.477	0.233
Unviable/insufficient fingerlings	0.226	0.857	0.125
Land acquisition problems among farmers	0.337	0.661	0.297
Attack of ponds by predators	0.160	0.163	0.907
Pollution of water sources	0.212	-0.390	0.668
Climatic uncertainties and flooding	-0.323	0.238	0.538
Lack of brood stock	0.242	0.540	-0.622
Low hatchability of fingerlings	0.325	0.476	-0.151
Farmers' unwillingness to participate	0.296	0.341	0.799
Improper water quality and quantity management by farmers	0.167	-0.141	0.594
Limited information on improved technology	0.663	-0.453	0.238

Source: Field survey, 2013

This agrees with Anene, Ezeh and Oputa (2010), who state that inadequate access to inputs was a major problem for fish farmers. Late arrival of GRP inputs and inadequate supply of inputs by GRP were indicated to be as a result of the recent flood in the area, which was said to have washed away the GRP brooding stocks. This affected the time of supply and quantity of GRP inputs supplied. There was also a resultant decrease in the impact of GRP on the socioeconomic lives of the farmers.

Sustainability constraints included:

- redundancy of extension personnel (0.898)
- difficulty in identifying training needs of target audience (0.580)
- low adoption of technology (0.705)
- attack of ponds by predators (0.907)
- pollution of water sources (0.668)
- climatic uncertainties and flooding (0.538)
- farmers' unwillingness to participate, and
- improper water quality and quantity management by farmers (0.594).

Climatic uncertainties and flooding led to losses of brood stock, delay in input supply and insufficient fingerlings. These hinder effective implementation of extension services of GRP as some farmers were reluctant to stock their ponds. Also farmers that intended to stock were not supplied sufficient fingerlings. The flooding should be controlled or prevented as much as possible. According to Bariweni, Tawari and Abowei (2012), flood control refers to all methods used to reduce or prevent the detrimental effects of flood waters. Some methods of flood control include: planting vegetation to retain extra water, terracing hillsides to slow flow down hills, construction of floodways (man-made channels to divert flood water) and construction of levees, dikes, dams, reservoirs or retention ponds to hold extra water during times of flooding (Bariweni *et al*. 2012). If these constraints are not properly handled, it might reduce the positive effects of the extension services on the fish farmers.

Conclusion and recommendation

Agricultural extension services and private sector extension services of GRP help to boost agricultural and fish production in Imo and Rivers States. The study assessed roles, effectiveness and constraints of private sector extension services of GRP in Imo and Rivers States, Nigeria. It assessed the role of private sector deliveries (PSD) in dissemination of agricultural and fishery technologies, effectiveness of the PSD and constraints to the PSD in the area. Roles of private sector extension services of GRP in farming technologies dissemination included training of farmers and provision of inputs for fish farming. There was significant improvement in the standard of living and size of production of the respondents after participation. Also, in terms of the effectiveness of the PSD on public policies, the programme had effect on beneficiaries' access to credit, education of wards and poverty reduction. Constraints to effectiveness of the private sector delivery of GRP included input-related constraints, such as inadequate funding, sustainability constraints, such as redundancy of extension personnel, and organisational constraints, such as limited information on improved technology.

It was recommended that:

- GRP personnel should be trained on latest technologies and provided with sufficient input (including fingerling) for the services.
- Farmers should be given sufficient fingerlings at the right time and also incentives for feed procurement or production.
- There should be adequate measures to help reduce or mitigate the effect of flood in the area, as many farmers have reduced their stock due to fear of flood.
- There should be more training for farmers on ways of formulating feed locally at a cheaper rate in order to reduce the effect of high cost of feed.
- There should be frequent studies on evaluation of impact of the extension services of GRP to ensure improvement of effectiveness and impact of the project on farmers.

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Competing interests

The authors declare that they have no financial or personal relationships which may have inappropriately influenced them in writing this article.

Authors' contributions

O.I.O. was the lead researcher. E.A.O., J.C.I. and O.M.A. were responsible for reading and editing the work to ensure that proper design and methodology were used.

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