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Original Article

A comparative profitability analysis of rice production under the anchor borrowers' programme for rice farmers association of Nigeria (RIFAN) in Kaduna State, Nigeria

OPEN ACCESS

Sunday Idorenyin NTA[1]*, Onehi Sunday ECHONO[2], Tavershima Stephen INGOROKO[3] & Kennedy Oziomah OBIOMAH[4]

[1]*Training Department, National Water Resources Institute, Mando Kaduna, Nigeria*
[2]*Department of Training, National Water Resources Institute, Kaduna, Nigeria*
[3]*Department of Water Resources and Environmental Management, National Water Resources Institute, Kaduna, Nigeria*
[4]*Research and Technical Services Department, National Water Resources Institute, Mando, Kaduna, Nigeria*

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ABSTRACT

The Central Bank of Nigeria Anchor Borrowers' Programme (ABP) since 2015 has provided huge support to rice farmers in Nigeria in terms of input supply through the Rice Farmers Association of Nigeria, with the intent to boost rice production. This study carried out a comparative profitability analysis of lowland rice production among beneficiaries and non-beneficiaries of the Anchor Borrowers' Programme in Kaduna State. 220 respondents were selected using multistage sampling techniques from six communities in Chikun, Kaduna South, and Igabi Local Government Areas, where the two (2) categories of lowland rice farmers with farm sizes of 0.5 ha and above were randomly selected. Descriptive statistics, multiple regression analysis, and net farm income were used in analyzing the data collected for the study. The findings revealed that sex, farming experience, rice farm size, and extension contact were factors that influenced the output of RIFAN beneficiaries of the ABP, while level of education, rice farm size, membership in a cooperative, and extension contact were variables that influenced the rice output of non-beneficiary rice farmers of the ABP. The gross margins of RIFAN member beneficiaries and non-beneficiaries of ABP were ₦116,019.00 and ₦114,016.9, respectively, with a net farm income of ₦104,831.20 and ₦103,566.30, respectively. The return on investment for RIFAN member beneficiaries and non-beneficiary of the ABP were ₦1.5k and ₦1.59k, respectively, with no significant difference between the net incomes for both categories of farmers.

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K E Y W O R D S : *Beneficiaries, Income, Output, Net Farm, Revenue*

INTRODUCTION

The Nigerian rice sector has seen remarkable developments over the last three decades. Production and consumption of rice in Nigeria have increased dramatically from 343,000 tonnes in 1970 to 8.44 million tonnes in 2019 (knoema, 2020). Notwithstanding, the production increase was insufficient to match the consumption increase - with rice imports making up the shortfall (Saliu, Isa, Grace and Uduma, 2014: Abubakar, Adamu and Aliyu, 2023). With rice now being an integral component of the Nigerian diet, it therefore called for

*Corresponding author: idorenyinsunday1@gmail.com; +2347033614411

urgent need to increase local rice production. Past policies and programmes have not been successful in securing the market share for local rice producers and other agricultural commodities (Olafe, Fredric, Akande, Titilola, Akpokoje and Ogundele, 2004)

Since the 1960s several programmes have been initiated. Most of the programmes were funded by the Central Bank of Nigeria and international organizations such as the World Bank and African Development Bank aiming at both attaining national self-sufficiency in rice and other agricultural products or increased welfare of the rural farmers and the nation's overall economic development.. Some of the programmes include Alliance for Green Revolution (Anchor Borrowers Programme,2016); Commercial Agricultural Credit Scheme (CACS, 2009); Agricultural Credit Support Scheme (ACSS, 2006); Community-Based Agriculture and Rural Development (2003); Multinational NERICA Rice Dissemination Project (2003); National Programme for Food Security (2002); SASSAKAWA Global (1992); Green Revolution Programme (GR, 1979); Agricultural Credit Guarantee Scheme Fund (ACGSF, 1977); Operation Feed the Nation (OFN, 1976); Agricultural Development Programmes (ADPs, 1974), National Accelerated Food Production Programme (NAFPP, 1972) etc. The development of Nigeria's agricultural sector is imperative, particularly to rice production, in that it has contributed significantly to the overall increase in grain production (knoema, 2020); providing employment through value chain system; provision of raw materials to agro allied industries among many others (Daneji, 2011). Kaduna state government, development plan 2016-2020 recognized the role of agriculture, as contributing to the economic development of the state, as the foremost area of economic development in the producing sector (Environment and Social Systems Assessment, 2018).

To this end, in 2016, the Kaduna state Government keyed into the Federal Government Agricultural Development Programme (Anchor Borrowers Programme) which was launched at the Federal level in 2015. The "Anchor Borrowers' Programme" is one of the Central Bank of Nigeria's policy initiatives to pursue development objectives, such as increased crop production especially rice production, reduction in food importation among others. Among the target crops for production, rice is rated high due to its high consumption level over the years (Doris, 2023 and Mary-Ann, 2019). The Programme aimed at accommodating a large number of rice farmers with a view to increasing output and significantly improving capacity utilization of integrated mills (Sam, 2019).

The rationale of the introduction of the Anchor Borrowers Programme (ABP), is realizing that restricting the importation of food products from accessing foreign exchange will not automatically translate to their local production, the CBN decided to complement the policy with a programme aimed at boosting local production of those agricultural products that dominates the country's food import bill of which rice product is one. The Anchor Borrower's Programme (ABP) in the promotion of local rice production through the Rice Farmers of Nigeria (RIFAN) provides rice farmers with rice farming inputs (seed, fertilizers, herbicides, pesticides, water pumps, sprayers, water intake hose and discharge hose, packaging bags) and start-up capital for Ploughing, harrowing, planting, harvesting, threshing, winnowing, bagging, and transportation.

To provide factual understanding on the effect of the Anchor Borrowers Programme on rice farming, a comparative analysis on economic cost and returns of rice production between RIFAN member beneficiary of the ABP and non-beneficiary rice farmer of the ABP was carried out under the following specific objectives: to determine the socio-economic characteristics of RIFAN members beneficiaries and non-beneficiary rice farmers of ABP, to determine the effect of the socio-economic variables on the rice output of RIFAN member beneficiary and non-beneficiary rice farmer of ABP, and to estimate the economic cost and returns of rice production of RIFAN member beneficiary and non-beneficiary rice farmer of ABP**.**

MATERIALS AND METHODS

Study Area

The study was carried out in Chikun, Igabi and Kaduna South LGAs of Kaduna state. Kaduna State shares border with Zamfara, Katsina, Niger, Kano, Bauchi, Nasarawa, Plateau States, and the Federal Capital Territory. It is located in the North Western part of Nigeria and globally, between Latitudes 9˚03¹ and 11˚32¹ North of the Equator and Longitudes 6˚05¹ and 8º 38¹ East of the Greenwich Meridian (KADP, 2013), with a total land mass of 46,053 km^2 and a population of 6,113,503 (Census, 2006).

Sampling

The study adopted purposive, stratified and simple random sampling techniques to select the respondents. At first, Chikun, Kaduna South and Igabi LGAs of Kaduna state were purposively selected based on their share in national crop area ecology (Olafe, *et al*, 2004) and being prominent rice producing areas in the State. Secondly, the

communities in each of the three selected LGAs were stratified into two strata (high producing areas and low producing areas). Thus, communities with 50% and above registered farmers into rice production were considered as high producing communities while, communities with below 50% of registered farmers into rice production were considered as low producing communities. Thirdly, from each of the strata, one community was randomly selected, making it a total of two communities from each of the three selected LGAs to give a total of six selected communities. The selected communities are Shada Bungai and Ungwan Pada village from Chikun LGA; Kakuri and Kurmi Mashi from Kaduna South LGA; and Afaka Mando and Barkalahu from Igabi LGA. Lastly, two (2) categories of upland rice farmers (RIFAN member beneficiary and Non-Beneficiary Rice Farmers of the Anchor CBN Borrowers' Programme) with farm sizes of 0.5 ha and above were identified in the six (6) selected rice producing communities with the help of Kaduna State Agricultural Development Programme (KADP) extension agents and Rice Farmers Association of Nigeria (RIFAN) staff.

The categories of farmers include farmers who are members of registered cooperative under RIFAN and have benefited in the 2018/2019 dry season rice farming supported by the CBN Anchor Borrowers' Programme and farmers who are non-members of RIFAN and did not benefit from the CBN Anchor Borrowers' Programme for 2018/2019 dry season rice farming. Thereafter, twenty percent (20 %) of the rice farmers who are RIFAN member beneficiary of ABP in each of the six selected communities were randomly selected through balloting. The choice of this, is in line with Sani and Oladimeji (2017) and adopted by Nwahia and Onyeabor (2020) who stated that ≥10% of the population is a fair representation of a large population. Thus, a total of 110 upland rice farmers who are RIFAN member beneficiaries of Anchor Borrowers' Programme were selected. In order not to introduce bias in the evaluation, equal number of Non-RIFAN members who never benefited from the Anchor Borrowers' Programme were also randomly selected. However, the selected numbers captured above 15% of the Non-RIFAN members.

Analytical tool

To achieve the objectives of this study, descriptive statistics (measures of central tendencies such as the mean, frequency distribution, standard deviation and percentages), the Cobb-Douglass were fitted to data generated using the Ordinary Least Square technique (OLS) under the assumption of the multiple regression model best fit was used. The explicit form of these functions take the

$$\boldsymbol{lny_i^2 = a + b_1 lnx_1^2 + b_2 lnx_2^2 + b_3 lnx_3^2 + b_4 lnx_4^2 + b_5 lnx_5^2 + b_6 lnx_6^2 + b_7 lnx_7^2 + b_8 lnx_8^2 + b_9 lnx_9^2} + \mu \ (\boldsymbol{double\ log}) \qquad (1)$$

Where; ln = natural logarithm, y_i = quantity of rice harvested (kg), x_1 = Sex (a dummy, 0 for the female while 1 for male), x_2 = Age (years), x_3 = level of education (years), x_4 = Marital status (a dummy, 0 for single while 1 for married), x_5 = Household size (numbers), x_6 = Farming experience (years), x_7 = Farm size (ha), x_8 = Membership of cooperative (a dummy, 0 for not a member and 1 for a member), x_9 = Extension contact (number of contact within the rice farming season), and μ = error term

b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8 and b_9 are parameters to be estimated, i = 1, 2, 3, 4,……n.

Gross margin was also employed to achieve the profitability of rice production under RIFAN members beneficiary and non-beneficiary rice farmers of CBN ABP as used by Olukosi and Erhabor (1988) farm budget estimate on per hectare basis.

GM = GI – TVC (2)

Where: GM = Gross Margin (₦), GI = Gross Income (₦), and TVC = Total Variable Cost (₦).

The difference between revenue and total variable costs is the gross margin for the enterprise, and, in essence, this is the return to capital, management and risk (Leonir, Antonio, Mauro, Marcelo, Paulo and José, 2024). It is expected that the higher the value of the profit margin, the more efficient the production will be. Net Farm Income (NFI) and Return per Naira Investment (RNI) were equally used to achieve objective 3, which is to determine the profitability of rice production in the study area. NFI is given by formula below:-

NFI= TR-TC (3)

Where: NFI= net farm income (₦), TR= total revenue (₦), TC= total cost of production (₦).

TC= TVC+TFC (4)

Where: TVC = Total variable cost (₦), TFC = Total fixed cost (₦).

While Return per naira invested (RNI) was obtained by dividing the gross income (GI) by the total cost (TC).

Thus:

$$RNI = \frac{GI}{TC} \quad (5)$$

Where**;** RNI = return per naira invested (₦), GI = gross income (₦), TC = total cost (₦).

T-test was conducted to test for significant difference of net farm income from beneficiaries and non-beneficiaries of the ABP.

RESULTS AND DISCUSSIONS

Multiple regression result on Effect of Socio-economic Factors on Rice Output

Multiple regression model was used to examine the effect of the socio-economic variables on the output of RIFAN members' beneficiary of ABP and non-beneficiary rice farmer of the ABP. Four functional forms of multiple regression were tested but semi log provided the best fit model and was adopted on the basis of R^2 and number of significant coefficients of the t-statistics. The regression results showed that about 61% and 45% of the variations in the rice output of RIFAN beneficiaries and non-beneficiaries rice farmers of ABP respectively was explained by the included explanatory variables (sex, age, level of education, marital status, household size, farming experience, farm size, membership of cooperative and extension contact). From the result in Table 1, it can been seen that sex (-0.2625), farming experience (0.0082), rice farm size (0.1847) and extension contact (0.0931) were the factors that influenced rice output of RIFAN beneficiaries rice farmers of ABP while level of education (0.0185), rice farm size (0.2850), cooperative (0.1759) and extension contact (0.1321) were the variables that influenced rice output of non-beneficiaries rice farmers of ABP.

Sex had a negative and significant (1%) relationship with rice output of RIFAN beneficiaries' rice farmers of ABP. This implied that a high proportion of male farmers will increase rice output as they put in more productive time into farming. This is in line with Amparo, Lopez and Ramoa, (2014) who stated that among other factors described, off-farm time burden due to engagement in off-farm work difference between men and women resulted to lower agricultural labour productivity in plots belonging to female in comparison to male.

Also, farming experience had a positive and significant (5%) relationship with rice output of RIFAN beneficiaries' rice farmers of ABP. The result showed that keeping other factors constant, 1% increase in the experience of the farmer in rice production, will increase their rice output by 0.01. This validates the assertion of Okoruwa and Ogundele (2006) who reported that years of farming experience should increase farming efficiency there by increasing output. Likewise, rice farm size had a positive and significant (1%) relationship with the rice output of RIFAN beneficiaries' rice farmers of ABP. This shows that there is a corresponding increase in rice yield when the farm size is increased. The result showed that keeping other factors constant, 1% increase in the farm size will increase their rice output by 0.19 and vice versa. This is in line with the work of Osanyinlusi and Adenegan (2016). As expected, extension contact had a positive and significant (5%) relationship with rice output of RIFAN beneficiaries' rice farmers of ABP. The result showed that keeping other factors constant, 1% increase in the extension visit to RIFAN beneficiaries rice farmers of ABP, will increase their rice output by 0.09 and vice versa.

For the non-beneficiaries rice farmers of ABP, the result in Table 1 showed that level of education had a positive and significant (10%) relationship with rice output of non-beneficiaries' rice farmers of ABP. This implies that as the level of education of non-beneficiaries rice farmers of ABP increases their rice output increases as well and vice versa. The result showed that keeping other factors constant, 1% increase in the level of education of non-beneficiaries' rice farmers of ABP, will increase their rice output by 0.19. This is in line with the findings of Kuria (2004) who stated that farmers' education provides the ease of adoption of modern farming innovation and technology, thus resulting to increased yield.

Likewise, rice farm size had a positive and significant (1%) relationship with rice output of non-beneficiaries rice farmers of ABP as 1% increase in the rice farm size of non-beneficiaries' rice farmers of ABP increases their rice output by 0.29. Membership of cooperative showed a positive coefficient of 0.18, which implies that an increase in membership of cooperative will influence rice output positively. This could be that membership of cooperative influences activities that benefit farmers which will in turn translate into improve output. The result sowed that 1% increase in membership of cooperative, will increase the rice output of non-beneficiaries' rice farmers of ABP by 0.18. This assertion validates the work of Osanyinlusi and Adenegan (2016). Also, extension contact had a positive and significant (10%) relationship with rice output of non-beneficiaries' rice farmers of ABP. Therefore, keeping other factors constant, 1% increase in the extension visit to non-beneficiaries' rice farmers of ABP will increase their rice output by 0.13 and vice versa. This is in line with (Aymen, Boubaker, Aw-Hassan, Samia and Ali, 2015).

Table 1: regression on effect of socio-economic variables on rice output

	Rifan beneficiaries rice farmers of ABP			non-beneficiaries rice farmers of ABP		
Variables	**Coefficient**	**Std err**	**t**	**Coef.**	**Std err**	**t**
Sex	-0.2625	0.0844	-3.11***	0.0218	0.1107	0.20
Age	-0.0047	0.0057	-0.83	0.0100	0.0101	0.99
Education	0.0159	0.0104	1.52	0.0185	0.0109	1.71*
Marital status	0.1243	0.1072	1.16	-0.1567	0.1304	-1.19
House size	-0.0083	0.0155	-0.54	0.0010	0.0193	0.05
Farm exp.	0.0082	0.0041	2.00**	-0.0081	0.0086	-0.94
Farm size	0.1847	0.0567	3.26***	0.2850	0.0967	2.96***
Cooperative	-0.0931	0.0925	-1.01	0.1759	0.1054	1.67*
Extension	0.0922	0.0445	2.07**	0.1321	0.0724	1.82*
Constant	8.0098	0.3151	25.42***	7.3840	0.3428	21.54***
No of obs		110			110	
F(9,100)		4.27			3.12	
Prob > F		0.0001			0.0024	
R^2		0.6774			0.5190	
Adj R^2		0.6124			0.4488	
Root msc		0.3876			0.4828	

Note: * is significant at 10%, ** is significant at 5% level and *** is significant at 1%

Profitability Analysis of rice production by RIFAN member beneficiaries and non-beneficiaries of the ABP

The profitability of rice production of RIFAN beneficiaries and non-beneficiaries of the ABP were examined using gross margin analysis, Net Farm Income and Return Per Naira Invested. The result of the analysis is presented in Table 2. The fixed cost for small scale rice production in this study includes cost of land rent and depreciation on fixed assets while the variable costs include cost of farm labour (land clearing, Ploughing, harrowing, weeding, harvesting, fertilizer application and agro-chemical application), seeds, fertilizer, agro-chemicals (pesticides and herbicides) and irrigation. The costs and returns were calculated based on average price of what the farmers received per hectare.

Table 2 shows that cost of labour (farm operations) accounted for the largest proportion (31.34% and 39.43%) of the total cost of rice production of RIFAN member beneficiaries and non-beneficiaries of the ABP, respectively, followed by cost spent in irrigating the rice farm for the duration of the rice production season, fertilizer, seeds and agro-chemical for both rice farmers categories. This agrees with the findings of Duvvuru and Motkuri (2013) and Madu and Aniobi (2018). The finding from the study revealed that the total cost of rice farming per hectare were ₦84,857.10 and ₦175,490.90 while the total revenue was ₦289,309.90 and ₦279,057.10 for RIFAN member beneficiaries and non-beneficiaries of the ABP respectively.

Table 2 further shows that the gross margins for the RIFAN member beneficiaries and non-beneficiaries of the ABP were ₦116,019.00 and ₦114,016.90 respectively. This implies that rice production is profitable for the two groups of rice farmers in the study area. The gross ratio which measures the solvency and success of rice farming business was found to be 40% and 41% for RIFAN member beneficiaries and non-beneficiaries of the ABP respectively. This shows that 40% and 41% of the gross income realized by RIFAN member beneficiaries and non-beneficiaries of the ABP is accrued to their total cost of rice production. Thus, rice production among the two farmers groups were economically viable. This finding is in line with the work of Lawal, Agboluaje and Liman (2013) who found a gross margin of ₦92, 948.00 in rice production in Southern Guinea Savanna of Niger State.

The Net Farm Income (NFI) obtained by RIFAN member beneficiaries and non-beneficiaries of the ABP were ₦104, 831.20 and ₦ 103,566.30 respectively. This shows that rice production by the two farmers groups is profitable. This confirms the assertion of Ben-Chendo, Lawal and Osuji (2017) who discovered NFI of ₦152,600 in paddy rice production in Kaduna state.

The return on investment (ROI) for RIFAN member beneficiaries and non-beneficiaries of the ABP were ₦1.57k and ₦1.59k respectively. This implies that for every one naira (₦1.00) invested by RIFAN member beneficiaries and non-beneficiaries of the ABP in rice

production, a profit of ₦0.57k and ₦0.59k were realized respectively, implying that rice production is profitable in the study area. This also shows that there was 57% and 59% return on investment for both farmers groups. This agrees with the work of Agunloye, Fasina and Akinnagbe (2017) who found a return on investment of ₦1.37 in their work on profitability investigation of rice production in Fufore Local Government Area of Adamawa state, Nigeria. The profit margin by RIFAN member beneficiaries and non-beneficiaries of the ABP were 36% and 37% respectively. This indicates that the rice farmers groups still have 36% and 37% respectively of their sales revenue to cover their operating costs. Though the NFI and Gross margin of RIFAN member beneficiaries of the ABP were higher than that of non-beneficiaries of the ABP, the non-beneficiaries of the ABP were able to realize more from every one naira invested in rice production.

Table 2: Cost and Return in rice production

	RIFAN				**Non -RIFAN**			
Variables	**Ave. qty/ha**	**Unit Price (₦)**	**Value/ha (₦)**	**%Tc**	**Ave. qty/ha**	**Unit Price (₦)**	**Value/ha (₦)**	**%TC**
a. Revenue output(Kg)	36.24	7,983.99	289,309.90		34.94	7,985.88	279,057.10	
b. Fixed input								
Land rent		9,188.09	9188.09	4.97		7,515.05	7,515.05	4.28
Depreciation		2378.16	2378.16	1.29		2,936.56	2,936.56	1.67
TFC			11,566.25				10,450.60	
c.Variable input								
Seed(Kg)								
Fertilizer(Kg)	23.44	538.23	12,613.57	6.82	59.08	282.36	16,682.58	9.51
Chemicals(li)	78.53	299.25	23,501.10	12.71	111.10	263.89	29,317.42	16.71
Labour(mandays)	4.52	6,544.87	29,605.64	16.02	4.93	3,267.35	16,109.55	9.18
Pulping machine hour(	179.55	36 7.63	57,937.85	31.34	188.86	366.43	69,203.18	39.43
Irrigation cost)	135.01		49,632.71	26.85	115.47	292.09	33,727.53	19.22
TVC								
d.Total cost			173,290.90				165,040.30	
e.Gross margin(a/c)			184,857.10				175,490.90	
f. Gross ratio			116,019.00				114,016.90	
g. NFI (a/d)								
h. profit margin			0.40				0.41	
i. RNI			104,831.20				103,566.30	
			0.36				0.37	
			1.57				1.59	

Hypothesis testing for the Significant Difference between NFI of RIFAN member beneficiaries and non-beneficiaries of the ABP.

The t test of difference between means of independent and equal sample size was used to test the second hypothesis which stated that there was no significant difference between the net farm income of **r**ice production of RIFAN members' beneficiary of ABP and non-beneficiary rice farmer of the ABP. The results of t-test are presented in Table 3. The results showed that t- calculated is lower than t-critical. This implies that there is no significant difference between the profits of both farmers groups. Therefore, the null hypothesis which stated that there is no significant difference between the net farm income of **r**ice production of RIFAN members' beneficiary of ABP and non-beneficiary rice farmer of the ABP was accepted. This implies that there was no significant difference between the profit made in **r**ice production of RIFAN members' beneficiary of ABP and non-beneficiary rice farmer of the ABP. This result resonate with similar studies conducted by Gona, *et al*. (2020) and Balogun, Adeyonu and Ayantoye (2021) which revealed that rice cultivation was profitable to both Beneficiaries and Non-Beneficiaries of the ABP, with beneficiaries having higher profit margin. However, these studies did not test for significant difference of the different profit level between both categories of rice farmers.

Table 3: t-test of significant difference between the net farm income of RIFAN members' beneficiary of ABP and non-beneficiary rice farmer of the ABP.

Variables	RIFAN NFI (₦)	Non-RIFAN NFI (₦)
Mean	104831.20	0.844536
Known variance	5.79E+09	0.013494
Observation	110	110
Pooled variance	1.1E+10	
Hypothesized Mean Difference	0	
Degree of freedom	218	
t-stat	0..084673	
P(<T=t) one tail	0.4663	
t-critical one tail	1.651873	
P(T<=t) two tail	0.932599	
t-critical two tail	1.970906	

CONCLUSION AND RECOMMENDATION

In conclusion, the finding of the study revealed that the programme did not significantly impacted profitably on beneficiaries farmers over non-beneficiaries of the ABP giving that the Gross Margins (₦116,019.00 and ₦114,016.90) and Return on Investments (₦1.57k and ₦1.59k) were positive, but showed no significant difference from the t-test.

There is therefore the need for the Central Bank of Nigeria to look into the service delivery system of the programme in order to identify potholes or bottlenecks which could have been the reason for the performance.

Authors 'Contribution

INS managed data collection, development of methodology, interpretation of analysed data, writing of manuscript and approved final manuscript. OSE reviewed first draft of manuscript. TSI data analysis and reviewed manuscript. KOO field data collection and provided material support

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Ethical Statement

Not applicable

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