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The effect of input value chain financing on rice farmer's efficiency in IFAD assisted value chain development Programme, Awka

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Abstract

To ensure the sustainability of the agricultural sector, some special arrangements should be made to increase farmers' access to credit through input loans. This study on the effect of input value chain financing on rice farmer's efficiency in the Value Chain Development Programme, Awka; specifically looks at the value chain financing options obtainable; its economic implication; its effect on food security, determinants of value chain financing effect on food security, and the efficiency of value chain financing on rice production sector. Data was collected from a cross-section of 200 farmers using a value chain financing arrangement. Descriptive statistics, multinomial logistic regression and data envelopment analysis were used for data analysis. The study revealed that 88.2% of the farmers received a certain percentage of input loan support, whereas, 78.2% received total input loan support. To the general economy of the nation, input value chain financing encourages early planting (87.1%), and enables the farmers to access production inputs (85.9%) which eventually springs forth food security in the country. Equally, the study found that value chain financing spurred 73.5% of the farmers to food security, while only 26.5% are food insecure. The food security index was 0.67 with a food security line of 38.3 USD for the farming household. We also discovered that a certain percentage of input loan support, guaranteeing farmers' financial loan applications and helping the farmers to pay for insurance premiums are the three determinants of relative food security. Whereas; certain percentage input loan, 100% input loan by value chain actors, and supports in payment of insurance premium are the four determinants of absolute food security in the study. The study, therefore, recommends that value chain financing should be adopted by stakeholders and policymakers to ensure the availability of credit to farmers.

Keywords: Input value chain financing; Data envelopment analysis; Rice production; Food security

1 Introduction

The Nigerian agricultural sector is an important industry that creates jobs for millions of people especially those in rural areas. This sector is important not only for rural development through employment creation and food supply, but it also supplies raw materials to the industry to grow the urban economy. This means that the agricultural sector is an attractive niche for developing countries [1]. Despite the sectoral importance in national history, it is dominated by smallholder farmers who are resource-poor and are stagnated with their inability to upscale their production systems [2]. Rice is an important crop in Nigeria's agricultural food basket which has often faced several challenges that necessitate programme interventions. In 2014; the International Fund for Agricultural Development (IFAD) submitted that the major problems of rice production in Nigeria are a paucity of opportunity for value addition, inadequate access to inputs and productive assets, scarcity of funds and credit, insufficient market and rural infrastructures, improved

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seeds among others [3]. Most of these challenges could be resolved through a value chain financing arrangement which IFAD assisted value chain programme is keying in as their programme exit strategy, after the realization that smallholders' farmers face many difficulties in accessing financial sources due to their inability to provide collateral for a formal source of credit [4].

Miller and Jones defined value chain financing as the flow of financial products and services through any point in a value chain that enables investments to increase actors' returns and the growth and competitiveness of the chain [5]. Many actors are involved in the Anambra State Value Chain Development Programme at different segments of the chain. In the upstream section of the chain are the input dealers, financial institutions and primary producers, whereas in the downstream section are the processors and marketers. Okpukpara *et al.* [6] suggested that smallholder farmers involved in value chain financing find it easier to access credit than those that lack value chain partners. Rice farmers often time act as out-growers to the processors, and in some quarters; the processors give the farmers input loans which they eventually buy back at the end of the farm season. This specialized arrangement ensures that farmers have access to the right variety which the processors need in their processing activities. Again, this arrangement expedites the production system since the farmers have timely access to farm inputs. Though; the sustainability of this arrangement is hinged on the integrity of the smallholder farmers. The interest in value chain financing should be anchored on those models that improve the inclusiveness, fairness, durability and financial sustainability and business relationships between small farmers and downstream agribusiness. Thus, Miller and Jones noted that input value chain financing contributes to GDP growth, helps in poverty reduction, improves financial inclusions in the agricultural sector, and increases the income of farmers among others [5]. Ityokumbul noted that value chain financing proffers solutions to food insecurity [7]. Many scholars like Chiambo *et al*. [8] and Ityokumbul [7] relates their study to farmer's immediate access to production inputs, but this present study focused on the impact of the value chain financing arrangement on the food security of the beneficiaries, and its effort to improve their efficiency of production to better the larger economy. Based on this background, the study specifically targets to:

- Identify the value chain financing options obtainable in the study,
- Ascertain the economic implication of the value chain financing in the agricultural sector,
- Describe the food security effect of value chain financing in the study,
- Determine the effect of value chain financing on food security in the study, and
- Estimate the efficiency of value chain financing to rice production of programme beneficiaries in the study.

2 Analytical model

2.1 Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) over years has proven to be the best tool used in evaluating the technical efficiency (TE) of firms in managerial decisions, apart from viewing TE as the ability to convert input into output [9], similar to the definition of Obianefo *et al*. who viewed efficiency as the ability of firms to produce the largest possible quantity of output from a given set of inputs, firms should be able to respond to economic signals or price fluctuation in production inputs [10]. This responsiveness to signs is necessary to benchmark efficiency value concerning firms operating in the industry. Sivarajah considered DEA as the best technique to study firms' efficiency since it uses linear programming methodology in estimation [11]. One advantage of DEA (non-parametric technique) over stochastic frontier analysis (SFA) is its ability to apply deterministic procedures in evaluating frontier [12]; this DEA is less sensitive to model misspecification as submitted by Watkins *et al.* [13].

This study comfortably adopted the DEA model developed by Charnes *et al.* [14] to evaluate a non-qualitative dataset on the economics of rice value chain financing and its implication for rice production in the sector. This model uses a linear programming methodology which has remained a powerful tool for DEA when compared to other management tools in production economics [8]. DEA is either executed in form of technical efficiency (TE) or scale efficiency (SE). The TE can be measured with two assumptions (a) – constant return to scale (CRS) which means that a change in output is proportionate to the quantity of input change, or (b) variable return to scale (VRS) which implies that production technology exhibit either decreasing or increasing return to scale [15]. The TE of DEA reveals the ability of the data management unit (DMU) to arrange and organize its inputs efficiently in the production process, this means that proper value chain financing will expedite production input organization. The above information suggests that pure TE will measure the performance index of managerial decisions. On the other hand; when this pure TE equate overall TE existing in DEA estimation, the outcome is known as a scale efficient unit [16]. The indication is that the business unit is operating at optimal size [10]. However, the DEA technique does not require a specific functional form distribution and can accommodate scale issues [16]. Thus, the model for this study defined the TE score as:

$$TE_n = Min\theta_n$$

Subject to

$$\sum_{i=1}^{l} \lambda_i X_{ij} - \theta_n X_{nj} \leq 0 \quad \forall_j$$

$$\sum_{i=1}^{l} \lambda_i Y_{ik} - \theta_n Y_{nk} \geq 0 \quad \forall_k$$

$$\sum_{i=1}^{l} \lambda_i = 1$$

$$\lambda_i = 0$$

Where: l is the set of farms (index i). j = set of inputs, and k = set of output (index k)

2.2 Parameter

X_{ij} is the vector of value chain input financing used by *ith* farm, X_{nj} is the vector of value chain input financing used by *nth* farm, Y_{ik} is the *k* outcome on the economics of rice production for *ith* farm, and Y_{nk} is the k outcome on the economics of rice production on the *nth* farm.

2.3 Decision

λ_i is the nonnegative weight for the *ith* farm, and θ_n is the TE for *nth* farm. DEA with the maximization function of linear programming assumed that $\theta_{n=1}$ means that the business unit is efficient, but less than 1 implies an inefficient business unit.

3 Material and methods

3.1 Study Area

The study was carried out among the rice beneficiaries of the Anambra State Value Chain Development Programme. The programme which is hosted by five Local Government Areas (Ayamelum, Anambra East, Anambra West, Orumba North, and Awka North) secured a loan from the International Fund for Agricultural Development (IFAD) in 2014 and began implementation in 2015 [17], later in 2019; the project secured additional finance to include three more LGAs (Ogbaru, Ihiala and Orumba South) based on comparative advantage in rice and cassava value chain [18]. Anambra state has favourable weather for rice and cassava value chain participation due to its location on latitudes 5°32' and 6°45' N and Longitude 6°43' and 7°22' E, with annual temperature and rainfall of 25.9^{o}C and 138mm respectively (climate-data.org). In Anambra State Value Chain Development Programme, there are several rice processors such as Udoka rice mill, Josan, Wisdom pack, and Coscharis rice mill who are major players in the downstream part of the value chain programme. These players are the actors giving out input loans (value chain financing) to farmers. Farmers sometimes act as out-growers to the processor to ensure a steady supply of raw material to the processors.

A multi-stage sampling technique was adopted to arrive at the right sample size through a descriptive survey. Shaughnessy *et al*. [19]; Meludu *et al*. [20] noted that a descriptive survey design or schedule samples an individual unit of a population or study representative. Thus, in the first stage, two LGAs (Ayamulum, and Awka North) known for active involvement with value chain financing in the programme were purposively selected. In the second stage; four rice production clusters were randomly selected from each LGA to make it eight rice clusters. Finally, twenty-five (25) rice farmers involved in value chain financing were randomly selected through the assistants of extension workers engaged in the programme. This brought the sample size to 200 respondents for the study. Table 1 shows the distribution of sample strata for the selected samples.

Table 1 Sample size distribution according to clusters

Local Government Areas	Cluster	Sample strata
Ayamelum	Anaku	25
	Omor	25
	Umumbo	25
	Ifte-ogwari	25
Awka North	Achalla	25
	Amanuke	25
	Awba Ofemili	25
	Ebenebe	25
Total		200

Source: Researcher's compilation

The questionnaire used for the data collection was designed in two sections, section A was designed to collect dependable data about the respondent's socioeconomic characteristics such as household size (number) and expenditure on monthly food consumption (USD). Section B was designed to capture data on the input value chain financing packages available and their economic implications. Farmers were allowed to tick as appropriate.

3.2 Data Analysis

A combination of analytical tools such as descriptive statistics, multinomial logistic regression, and data envelopment analysis (DEA) was used to achieve the stated objectives of the study. Objectives one, two and three were achieved with descriptive statistics such as percentage and chart; the intention for these objectives are to describe the percentage of occurrence of the variables. Objective four was achieved with the multinomial logistic regression model, the reason for this model was that the researcher(s) intend to understand the relationship between the independent and dependent variables. Lastly, objective five was achieved with DEA. This non-parametric tool was used as a substitute for frontier analysis due to the qualitative nature of the variables.

- The descriptive statistics used for objective one, two and three is defined as:

$$p = \frac{x * 100}{X}$$

Where: p is the percentage outcome, x is the observed outcome, and X is the expected outcome

- The food security index was estimated with the formula used in Osuafor et al. [21] defined as:

$$fI = \frac{PCFCE}{\frac{2}{3}MFCE}$$

Where: FI is the food security index, PCFCE is the per capita food consumption expenditure for ith household, and MFCE is the per capita food consumption expenditure for all households. These indicators are measured in USD. Omonona and Agoi [22] noted that to be food secure, households should spend at least two–thirds of their budget on food consumption.

- Multinomial Logistic Regression adopted by Shah et al. [23]; Garson [24] and El-Habil [25] to estimate the effect of value chain financing on food security is defined as:

$$Log(\pi_j\,(X_i) = \frac{exp^{\alpha_{oi}+\beta_{1j}X_{1i}+\beta_{2j}X_{2i}+\cdots\beta_{pj}X_{pi}}}{\sum_{j=1}^{k-1} exp^{\alpha_{oi}+\beta_{1j}X_{1i}+\beta_{2j}X_{2i}+\cdots\beta_{pj}X_{pi}}}$$

Where π is the effect of value chain financing on food security, X_i is the vector(s) of explanatory variables (value chain financing packages), β_j is the parameter to be estimated.

Afterwards, the MLR probability model used in Chatterjee and Hadi [26] will be adopted to establish the probability of affecting the food security status of the beneficiaries of the programme defined as:

$$\widehat{\pi_1} = \frac{exp(y_i)}{1+\sum exp(y_i)}$$

Where y_i is the predicted responses from the exponential value of MLR result.

4 Results and discussion

4.1 Value chain financing obtainable in the study

The types of value chain financing approach adopted in the study area are presented in Table 2. The result shows that farmers (88.2%) are supported with a certain percentage of their input cost by the processors and or Agro-dealers who eventually buy back the product to offset their input loans. 78.2% of the farmers reported total input support by the processors and or Agro-dealers, this arrangement means that the farmers serve as out-growers to the processors to ensure a steady supply of processors' raw materials and farmers' output for sustainability. Equally, 63.8% of the farmers benefited from technical support on production technology or techniques, this support could come in form of training to improve farmers' knowledge of certain production techniques. 38.6% of the farmers noted that the value chain financing arrangement serve as guarantors to the farmers during loan processing with the financial institutions. The aim is to ensure the availability of credit during the farming season. Furthermore, the value chain financing arrangement gives insurance support to farmers in form of premium payments to reduce the risk or shock borne by the farmers during unforeseen circumstances. The study by Hes and Hazell [27]; Ehiogu and Chidiebere-Mark [28] alludes that the premium payment for agricultural insurance cover represents a particular claim for a specific available window. Whereas, Chukwujekwu *et al.* [22] submitted that an effective indemnifying of the farmers during hazardous moments will help to boost the morale of women and youths participating in agriculture insurance to recover their investment if any risk happens.

Table 2 Value chain financing obtainable in the study

Sn.	Value chain financing	Percentage
1	Sum % input support by processors and agro-dealers with buyback arrangement	88.2
2	Total input support by processors and agro-dealers with buyback arrangement	78.2
3	Technical support to farmers on production techniques to improve production	63.8
4	Provision of guarantor services to farmers during loan processing with financial institutions	38.6
5	Support for insurance premiums to reduce default or agricultural risk	10.4

Source: Field Survey, 2022.

4.2 The economic implication of the value chain financing in the agricultural sector

One good thing about the present study is that it also considers the economic implication of the value chain financing to the agricultural sectoral economy. The result is presented in figure 1. It was revealed that the majority (87.1%) of input value chain financing (IVCF) enables early or timely planting. This means that IVCF encourages timely onset of farming season in the agriculture economy. Also, 85.9% of farmers noted that value chain financing ensures timely access to quality farm inputs, this response is in agreement with Zuberu *et al.* [29] who viewed this approach of VCF as agricultural financing that deals with input supply to ameliorate the issues of lack of credit. Because of the formal arrangement involved; the processors and or the Agro-dealers will go for improved or high-quality inputs that guarantee a return on their investment through an input loan. It was also observed that 74.4% of farmers suggested that VCF reduces food scarcity and hunger. This is because this arrangement will encourage early harvesting and availability of food basins in the nation's agricultural economy. Lastly, 64.1% of the farmers believe that VCF will reduce the pressure on importation of food. When farmers are equipped and mobilized early to farm, it will help to increase the number of foods supplied to the nation's economy, as well as reduce importation by the government to balance the

food supply deficit in the country. We, therefore, appreciate the study by Ayodele [30] who recommended that VCF is like a debt-equity swap option necessary to ensure agricultural-led economic growth in Nigeria.

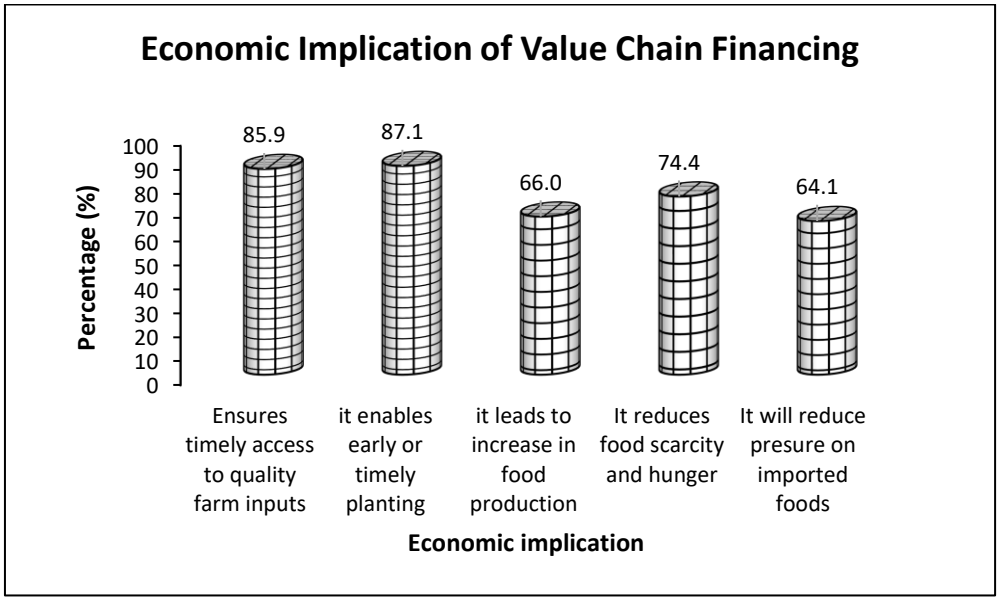

Figure 1 The economic implication of the value chain financing in the agricultural sector

4.3 Food security effect of value chain financing

The food security status of the farming household in the study is presented in Table 3. The Table shows that the Total Food Consumption Expenditure (TFCE) among the farming households participating in the value chain financing is 57,443.3USD; the Mean Food Consumption Expenditure (MFCE) is 287.2USD; the Average mean per capita household expenditure is 57.4USD and 2/3 per capita food consumption expenditure (PCFCE) that represents the benchmark or food security line is 38.3USD. We found the food security index (FI) to be 0.67, this index value shows that 73.5% of the respondents are food secure, while only 26.5% are food insecure. This shows that the input value chain financing arrangement gives farmers access to enough farm input to improve their products which will eventually result in national food security. This high number of farmers (73.5%) that are food secure agree with a similar food security estimation approach by Osuafor *et al.* [21] who found that 89.59% of their respondents are food secure. The study by Saediman *et al.* [31] also recorded households that are food secure as 81.2%. This study agreement with the other studies shows how important input value chain financing could be to improve the welfare of farmers.

Table 3 Food security effect of value chain financing in the study

Item description	Findings
Total food consumption expenditure (TFCE)	57443.3
Mean food consumption expenditure (MFCE)	287.2
Average mean per capita household expenditure	57.4
2/3 per capita food consumption expenditure (PCFCE)	38.3
Food security index (FI)	0.67
Food secure	147 (73.5%)
Food insecure	53 (26.5%)
mean household size	5
Observation	200

Source: Field Survey, 2022. N450 = 1USD

4.4 The effect of value chain financing on food security in the study

The regressive effect of the value chain financing (VCF) variables on food security which is the aim of the study is presented in table 4. The variables are defined as sum % input support by processors and agro-dealers with buyback arrangement (VCF1), total input support by processors and agro-dealers with buyback arrangement (VCF2), technical support to farmers on production techniques to improve production (VCF3), provision of guarantor services to farmers during loan processing with financial institutions (VCF4), and support for insurance premium to reduce default or agricultural risk (VCF5). The data for this particular multinomial regression stemmed from the food security result (Table 3) where the farmers with a food security index below 0.5 represent food insecurity, 0.50 – 0.69 is relative food security, and 0.7 and above is absolutely food security

Diagnostically, the Log likelihood ratio value was found as 332.103, and the Likelihood ratio test value was 19.87 which is significant at a 1% level of statistical significance. The implication is that the model was fit to explain the model interactions, again, all the variables included in the model were relevant to the execution of the analysis. The Pseudo R^2 value of 0.112 shows the relationship between the explained and unexplained variation in the model. It, therefore, implied that the 11.2% variation in the effect of input value chain financing (IVCF) on food security is explained by their internal relationship, while the remaining 88.8% explained resulted from external factors. These external factors could be coming from the impact of the Covid-19 lockdown as suggested by Meludu *et al.* [20], disruption of the world economic food supply chain as a result of the Ukraine – Russia war, and heated insecurity situation in Nigeria among other issues causing food crises in Nigeria. The above necessitates the need to intensify this value chain arrangement in the input value chain development programme.

Based on the two categories of food security (relative and absolute), the following findings are peculiar to relative food security:

The marginal effect size of VCF1 (β = 0.526 @ 6.76***) was negatively significant at a 0.01 level of probability, this implies that a 1% increase in the number of farmers that are not supported with a certain percentage input loan by processors and Agro-dealers will reduce relative food security in the study by 52.6%. This value is very high to suggest the need to intensify value chain financing in the programme.

Table 4 The effect of value chain financing on food security in the study

	Relatively secure				**Absolute security**			
Parameter Estimates	**B**	**Std. Error**	**Wald**	**Exp(B)**	**B**	**Std. Error**	**Wald**	**Exp(B)**
Intercept	-0.524	1.667	0.10		0.359	1.104	0.11	
VCF1	-0.642	0.247	6.76***	0.526	-0.481	0.175	7.58***	0.618
VCF2	0.050	0.182	0.08	1.052	0.179	0.121	2.19**	1.196
VCF3	-0.075	0.250	0.09	0.928	0.080	0.158	0.26	1.083
VCF4	0.358	0.255	1.98**	1.431	0.100	0.152	0.44	1.105
VCF5	0.359	0.246	2.14**	1.432	0.401	0.166	5.85***	1.494
Diagnostic statistics								
Pseudo R^2	0.112							
Log Likelihood	332.103							
LR Test	19.87							
Probability	0.494				0.506			
Obs.	200							

Source: Field Survey, 2022.

Also, the marginal effect size of VCF4 (β = 1.431 @ 1.98**) was positive and significant at a 0.05 level of probability, this implies that a 5% increase in the number of farmers that the value chain actors (processors and Agro-dealers) guaranteed to financial service providers during loan process will increase relative food security by 1.431 unit.

Furthermore, the marginal effect size of VCF5 (β = 1.432 @ 2.14**) was positive and significant at a 0.05 level of probability, this implies that a 5% increase in the number of farmers that the value chain actors (processors and Agro-dealers) support in payment of insurance premium to reduce default or agricultural risk will increase relative food security by 1.432 unit.

4.4.1 Absolute security

The marginal effect size of VCF1 (β = 0.618 @ 7.58***) was negatively significant at a 0.01 level of probability, this implies that a 1% increase in the number of farmers that are not supported with a certain percentage input loan by processors and Agro-dealers will reduce absolute food security in the study by 61.8%. This is also high as was obtained in relative food security. Also, the marginal effect size of VCF2 (β = 1.196 @ 2.19**) was positive and significant at a 0.05 level of probability. The implication is that a 5% increase in the number of farmers that are supported with 100% input loan by value chain actors (processors and Agro-dealers) will increase absolute food security by 1.196 units. At this juncture, farmers are not worried about how to procure quality farm inputs for their farming operations. This will spur them for early planting and timely harvest of farm produce, this has backward integration because part of their harvest will be given to the processor to pay back for the input loan. Finally, the marginal effect size of VCF5 (β = 1.494 @ 5.85***) was positive and significant at a 0.01 level of probability, this implies that a 1% increase in the number of farmers that the value chain actors (processors and Agro-dealers) support in payment of insurance premium to reduce loan default or agricultural risk will increase absolute food security by 1.494 unit.

Summarily, the study revealed that value chain financing has a 49.4% and 50.1% probability or chances of spurring or causing an increase in relative and absolute food security in the study respectively. These observations based on the significant variables validate the assertion made by Lawal and Abdullahi [32] who suggested that support for farmers fast tracks the development of the agricultural sector in Nigeria, and spurs the general economic growth.

4.5 Estimate the efficiency of value chain financing to the agriculture sector in the study

Table 5 The efficiency of value chain financing to the agriculture sector in the study

DMU	TE	DMU	TE	DMU	TE	DMU	TE	DMU	TE
1	0.78	41	1.00	81	0.80	121	1.00	161	0.69
2	1.00	42	0.74	82	0.80	122	0.75	162	0.80
3	1.00	43	0.60	83	0.60	123	1.00	163	0.97
4	0.85	44	0.57	84	0.60	124	0.69	164	1.00
5	0.78	45	0.88	85	0.41	125	0.75	165	1.00
6	1.00	46	0.33	86	0.54	126	0.55	166	0.63
7	0.59	47	1.00	87	0.95	127	0.64	167	0.60
8	0.60	48	0.39	88	0.80	128	0.37	168	1.00
9	0.69	49	1.00	89	0.80	129	0.64	169	0.53
10	0.40	50	1.00	90	0.60	130	0.80	170	1.00
11	0.74	51	0.60	91	0.80	131	0.91	171	1.00
12	0.60	52	0.60	92	0.60	132	0.48	172	0.60
13	0.80	53	1.00	93	1.00	133	0.80	173	0.98
14	0.64	54	0.60	94	0.64	134	0.60	174	0.76
15	0.74	55	0.40	95	0.40	135	0.50	175	0.78
16	0.90	56	1.00	96	1.00	136	0.87	176	1.00
17	1.00	57	0.64	97	1.00	137	0.62	177	0.80
18	0.64	58	0.35	98	0.60	138	0.80	178	1.00
19	0.77	59	1.00	99	0.56	139	0.88	179	0.64

20	0.87	60	0.47	100	0.80	140	1.00	180	0.92
21	0.79	61	0.80	101	0.40	141	0.86	181	0.60
22	0.74	62	0.74	102	0.96	142	0.72	182	0.40
23	0.66	63	0.85	103	0.32	143	0.93	183	0.77
24	0.71	64	0.83	104	0.87	144	0.54	184	0.72
25	1.00	65	0.60	105	0.88	145	1.00	185	0.91
26	0.60	66	0.40	106	1.00	146	0.59	186	0.53
27	0.71	67	1.00	107	0.71	147	1.00	187	0.65
28	0.40	68	0.36	108	0.83	148	0.41	188	1.00
29	0.72	69	0.84	109	0.96	149	0.83	189	0.72
30	0.61	70	0.70	110	1.00	150	0.73	190	0.69
31	0.60	71	0.69	111	0.55	151	0.93	191	0.60
32	1.00	72	0.60	112	0.98	152	1.00	192	0.80
33	0.39	73	0.60	113	1.00	153	0.95	193	0.38
34	0.35	74	0.85	114	0.65	154	1.00	194	0.68
35	0.51	75	0.80	115	1.00	155	0.70	195	0.51
36	1.00	76	0.29	116	0.36	156	0.49	196	0.80
37	1.00	77	1.00	117	0.75	157	0.84	197	0.80
38	0.30	78	1.00	118	0.40	158	0.66	198	0.64
39	1.00	79	0.77	119	0.60	159	0.89	199	0.72
40	0.83	80	0.68	120	1.00	160	1.00	200	1.00

Source: Field Survey, 2022. Mean scale efficiency = 0.743

To verify the impact of value chain financing on the efficiency of agricultural production or the crop sectorial economy, a non-parametric technical efficiency approach called the data envelopment analysis (DEA) technique was adopted. The result is presented in table 3. We found out that 44 data management unit (DMU) representing the individual farmer's identity in the dataset which also stood for 22.0% of the total respondents has attained scale efficiency. This gives room to request more input value chain financing in the programme to bring the remaining 78.0% of the farmers into efficient food production or absolute food security in the study. The mean scale efficiency of 0.743 indicates that in the short run, the farmers are only 25.7% below the expected absolute food security margin as a result of the value chain financing in the programme. This study will in no doubt, recommend value chain financing as a sustainability strategy for agricultural programmes in Nigeria.

5 Conclusion

To ensure the sustainability of the agricultural sector, farmers' access to credit should be improved. Since this will help to reduce the issues bordering around inadequate capital or production funds. Thus, leveraging input support through some special arrangement becomes sacrosanct to this study on the effect of input value chain financing on the efficiency of farmers in the value chain development programme, in Anambra State. The study specifically identified the value chain financing options obtainable, ascertained the economic implication of value chain financing, described the food security effect of value chain financing, determined the effect of value chain financing on food security, and estimated the efficiency of value chain financing to the agriculture sector. We employed different analytical techniques like descriptive statistics, multinomial logistic regression and data envelopment analysis (DEA) to arrive at an important finding in the study. Empirically, the study revealed that 88.2% of the farmers received a certain percentage of input loan support, whereas, 78.2% of the farmers reported total input loan support as the value chain financing arrangement existing in the area. To the general economy of the nation, value chain financing encourages early planting or onset of the farming season (87.1%), and enables the farmers to access production inputs (85.9%) which eventually springs

forth food security in the country. Though, food security is expected to start from the individual farmers' households. Equally, the study found that value chain financing spurred 73.5% of the farmers to food security, while only 26.5% are food insecure. The food security index was 0.67, with a food security line of 38.3 USD for the farming household. These findings are very encouraging, and we observed we also discovered that a certain percentage of input loan support, guaranteeing farmers financial loan applications and helping the farmers to pay for insurance premiums are the three determinants of relative food security. Whereas; certain percentage input loan, 100% input loan by value chain actors, and supports in payment of insurance premium are the four determinants of absolute food security in the study.

Recommendations

The study, therefore, recommends that value chain financing should be adopted by stakeholders and policymakers to ensure the ready and steady availability of credit through input loans.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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