ECONOMIC IMPACT ASSESSMENT OF THE AGRICULTURAL TECHNOLOGIES GENERATED BY THE NATIONAL AGRICULTURAL RESEARCH INSTITUTES, NIGERIA, VOL. III

By

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LIST OF ACRONYMS AND ABBREVIATIONS

ARCN	AGRICULTURAL RESEARCH COUNCIL OF NIGERIA
IAR	INSTITUTE FOR AGRICULTURAL RESEARCH (SAMARU)
IAR & T	INSTITUTE FOR AGRICULTURAL RESEARCH AND TRAINING (IBADAN)
IITA	INTERNATIOAL INSTITUTE OF TROPICAL AGRICULTURE (IBADAN)
NAPRI	NATIONAL ANIMAL PRODICTION RESEARCH INSTITUTE (SHIKA)
NARIs	NATIONAL AGRICULTURAL RESEARCH INSTITUTES
NCRI	NATIONAL CEREALS RESEARCH INSTITUTE (BADEGGI)
NIFOR	NATIONAL INSTITUTE FOR OIL PALM RESEARCH (BENIN CITY)
NIHORT	NATIONAL INSTITUTE FOR HORTICULTURAL RESEARCH (IBADAN)
NRCRI	NATIONAL ROOT CROPS RESEARCH INSTITUTE (UMUDIKE)

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Executive Summary

During the 2008 and 2009 social and economic impact assessments of the agricultural technologies generated by the NARIs, emphasis was placed on only one (released) variety or breed of a commodity. In the present edition of the economic impact assessment, we have extended the frontier of the study to cover all the varieties/breeds of a particular commodity that are already with farmers. In effect, the ambitious aim is to estimate the cumulative economic gains to society from all the varieties already released of each nominated commodity.

Context of the study

Agricultural research, whether crop or livestock, is expected to generate increasingly improved varieties and breeds. Whatever the aims of varietal or breed improvement (disease resistance, better fertilizer response, drought tolerance, pest resistance, hardiness, etc), the ultimate aim is to achieve increase in productivity. It is expected that a new variety or breed will out-perform previous varieties or breeds on a wide range of experimented parameters.

Objectives of the study

The broad objective of this study is the conduct of economic impact assessment of the agricultural technologies generated and released by the NARIs. The specific objectives of the study are to:

(i) Estimate the annual trends in the household level hectarage of identified varieties of the relevant crops;
(ii) Estimate the annual trends in the household level number of identified breeds of the relevant livestock;
(iii) Estimate the annual trends in the adoption rates of the identified varieties and breeds of the relevant commodities;
(iv) Estimate the annual value and distribution of the cumulative gains from varietal and breed adoption

Methodology

Scope of the study

As far as possible, the study was focused on the commodities not covered in the 2008 and 2009 editions of the economic impact studies. The commodities presently covered are Sorghum, Cowpea, Cassava, Rice, Okra, Oil Palm and ShikaBrown poultry layers.

Data analysis

Specific objectives (i) and (ii) utilized the annual average hectares of land under each variety, and the average number of ShikaBrown layers kept by farmers per annum, respectively. Specific objective (iii) was achieved by computing the hectares under each variety as a proportion of the total hectares under the crop. For the ShikaBrown layers, adoption rate in each year was computed as the proportion of ShikaBrown in the total number of layers (all breeds) kept by the farmers in the sample. We used a hybrid of the Willam Masters (1996) and Akino-Hayami (1975) models for computing the social gains and distribution among the producers and consumers for each candidate commodity.

Limitations of study

The key limitations of the study relates to the quality of the various data sets. The aggregate time series data were obtained from the various major sources which are hardly comparable between agencies in any given year. The exercise of asking farmers to recollect the hectares under each variety or the number of different poultry layers kept over a 19-year period was extremely ambitious. However, averaging the annual responses across the sample of respondents in each year might have smoothened out the memory errors that would have been inherent in individual responses.

Results and Discussion

Annual average areas under the technologies

Okra

During the 1997-2008 period, the average area under the local, NHA e 47-4 and LD-88 varieties of Okra were 0.99ha, 0.28ha and 0.96ha, respectively.

Cowpea (IAR)

During the 1996-2008 period the farmers grew an average of 0.78ha of SAMPEA 6 and an average of 0.66 ha per annum of SAMPEA 8 during the 2005-2008 period.

Sorghum

The average areas under SAMSORG 38, SAMSORG 39, SAMSORG 40 and SAMSORG 41 during the 1997-2008 period were 1.01 ha, 0.64 ha, 0.43 ha and 1.47 ha, respectively.

Cowpea (IAR & T)

On the average farmers grew 0.065 ha of the local variety during the 1990-2008 period. However, in apparent abandonment of the local variety (Abeweja), the farmers in the survey grew an average of 1.14 ha of Ife Brown during the same period.

Cassava

Farmers in the survey grew, on the average, 0.79 ha of TMS 30372 during the 1991-2008 period and 1.25 ha of NR 8082 during the 1998-2008 period.

Rice

Farmers planted FARO 44, FARO 52, FARO 46, FARO 48 and FARO 55 at annual averages of 2.33 ha, 1.95 ha, 0.49 ha, 0.33 ha and 1.27 ha, respectively during the relevant adoption periods.

ShikaBrown layers technology

Although ShikaBrown was released in 2000, farmers appeared to have got access to the breed earlier, possibly on trial basis.

Trends in technology adoption rates

Okra

During the 1997-2008 period, the mean adoption rates for the local, NHA e 47-4 and LD-88 varieties were 52.9%, 9.9% and 37.1%, respectively.

Cowpea (IAR)

The mean adoption rates for SAMPEA 6 during the 1996-2008 period is 87.8% and 12.2% for SAMPEA 8 during the 2005-2008 period.

Sorghum

The mean adoption rates for SAMSORG 38, SAMSORG 39, SAMSORG 40 and SAMSORG 41 are 27.9%, 16.1%, 13.5% and 42.6%, respectively during the 1997-2008 period.

Cowpea (IAR & T)

. The mean adoption rates during the 1990-2008 period for the local, Ife Brown and Ife Bimpe varieties were 4.1%, 86.3% and 9.6%.

Cassava

The mean adoption rates for TMS 30572 and NR 8082 during the period were 69% and 31%, respectively.

Rice

During the 1992-2008 period the mean adoption rates for rice varieties FARO 44, FARO 46, FARO 48, FARO 52 and FARO 55 are 59.4%, 12.8%, 7.9%, 13.8%, and 6.2%, respectively.

ShikaBrown layers

The mean adoption rate during the 1990-2008 period is 86.7%. Perhaps due to the discrete nature of the poultry data the adoption rate series consists of jumps between years.

Amount and distribution of social gains from adopting technologies

Okra

On the average, consumers gained N0.882bn per annum while producers lost N0.248bn per annum from the adoption of these Okra varieties. In the aggregate, society gained N0.633bn per annum during the 1998-2008 period.

Cowpea (IAR & T)

On the average, consumers gained N69.35bn per annum while producers gained N43.05bn per annum from the adoption of the Cowpea varieties under study.

Rice

The average, consumers gained N660.99bn per annum, while producers gained N64.09bn per annum during the 1992-2008 period. Society gained N725.08bn per annum, on the average.

Cassava

It is computed that, on the average, the cumulative gains to consumers and loss to producers of Cassava were N277.79bn and N44.77bn per annum during 1998-2008 period. Society, on the average, gained N233.02bn per annum during the period 1998-2008 period.

ShikaBrown layers

On the average, consumers gained N172.06bn per annum while producers gained N142.47bn per annum from the adoption of the ShikaBrown layers during the 1990-2008. Society, on the average, however gained N314.52bn per annum from the development and adoption of the layers breed under review.

Conclusions and Recommendations

The results obtained in the foregoing sections reinforce two inevitable conclusions. One, the drop-out of the local or older improved varieties from the adoption portfolio of farmers suggests the need for continuous research towards evolving better varieties. A halt of varietal or breed improvement research could lead to loss in productivity and competiveness by the relevant commodity with the passage of time. Two, but not unique to this study only, the monetary gains from technology adoption is higher for consumers than producers under regimes of price inelastic demand and supply. This means that public investment must be assured particularly and continuously in non-traded food-based agricultural research in Nigeria, since most of the gains will ultimately end up with the consumers.

Introduction

Agricultural research is widely believed by development experts to be the driver of technical change, economic growth and development. Thus, the need for continuous and increasing public and private investments in agricultural research cannot be over stressed. As a direct consequence of agricultural research, farmers will increase their productivity through the adoption of improved inputs and practices, and raise their real incomes. Agricultural research covers a wide array of issues including crop breeding, livestock breeding, crop protection, rates and methods of applying such inputs as fertilizers and agro-chemicals, to mention a few. The ultimate aim is to increase crop and livestock productivity.

During the 2008 and 2009 social and economic impact assessments of the agricultural technologies generated by the NARIs, emphasis was placed on only one (released) variety or breed of a commodity. In the present edition of the economic impact assessment, we have extended the frontier of the study to cover all the varieties/breeds of a particular commodity that are already with farmers. In effect, the ambitious aim is to estimate the cumulative economic gains to society from all the varieties already released of each nominated commodity.

Agricultural research, whether crop or livestock, is expected to generate increasingly improved varieties and breeds. Whatever the aims of varietal or breed improvement (disease resistance, better fertilizer response, drought tolerance, pest resistance, hardiness, etc), the ultimate aim is to achieve increase in productivity. It is expected that a new variety or breed will out-perform previous varieties or breeds on a wide range of desired parameters. The questions then are: what is the cumulative gain or benefit to the Nigerian society from the basket of varieties or breed of a particular commodity? How does this cumulative gain to society distributes among consumers and producers of each commodity?

Objectives of the study

The broad objective of this study is the conduct of economic impact assessment of the agricultural technologies generated and released by the NARIs. The specific objectives of the study are to:

(v) Estimate the annual trends in the household level hectarage of identified varieties of the relevant crops;
(vi) Estimate the annual trends in the household level number of identified breeds of the relevant livestock;
(vii) Estimate the annual trends in the adoption rates of the identified varieties and breeds of the relevant commodities;

(viii) Estimate the annual value and distribution of the cumulative gains from varietal and breed adoption

Methodology

Scope of the study

As far as possible, the study was focused on the commodities not covered in the 2008 and 2009 editions of the economic impact studies. The commodities presently covered are Sorghum, Cowpea, Cassava, Rice, Okra, Oil Palm and ShikaBrown poultry layers. Oil palm could not be included in the analysis undertaken because the Tenera variety was analyzed in the 2008 edition and the emerging data from the Tenera only is unlikely to add value to the previous results. Cowpea was proposed for analysis for IAR Samaru and IAR&T, Ibadan. Adoption trends were traced for the data provided by both IAR and IAR&T, but data problems necessitated dropping the Cowpea from IAR from economic impact analysis. The Sorghum data was used in the adoption stage of the study, but was dropped from the economic impact analysis. Sorghum varieties could not be assessed for their economic impact because the four varieties (SAMSORG 38, SAMSORG 39, SAMSORG 40, SAMSORG 41) were indicated to each have on-farm yield of 2.0 to 2.5 mt/ha and on-station yield of 2.5 to 3.5 mt/ha. This implies zero yield gain between any pair of varieties and zero cumulative yield gain moving from SAMSORG 38 to SAMSORG 41, whether one uses the on-farm or on-station yield data. This situation does not meet the minimum condition for the intended analysis.

Rice was previously studied in 2008 but for a single variety. This time, the Rice data expands to cover five lowland and upland varieties. ShikaBrown layers were studied in the 2008 edition, but critical data limitations did not allow economic impact assessment then. Significant attempts were made to overcome this data problem in the present study. Thus, only Okra (NIHORT), Cowpea (IAR&T), Cassava (NRCRI), Rice (NCRI), and ShikaBrown layers (NAPRI) made the economic impact analysis stage. The data period proposed for all studies was 1990 to 2008, different from the 1997-2008 period used in the 2008 and 2009 studies.

On-station and Household survey

The ‘cumulative gain’ approach to the present study necessitated the need for extensive on-station and /or on-farm yield data especially for the different varieties of crops studied. The data solicited from the participating crop-based NARIs included

(i) Year variety/breed was released ;
(ii) Log book estimate of annual on-station yield/mt;
(iii) Log book or other estimate of annual on-farm yield/mt;
(iv) Best estimate of annual on-station research cost on variety before release ;

(v) Best estimate of annual on-farm research cost on variety before release

The household level data collected in respect of crop varietal analysis included:

(i) Approx area under variety 1 by year (ha);
(ii) Approx area under variety 2 by year (ha);
(iii) Approx area under variety 3 by year (ha);
(iv) Approx area under variety 4 by year (ha)

Some of the issues which the ShikaBrown layers adopters responded to included:

(i) Year ShikaBrown was first adopted by farmer
(ii) Number of layers owned by the farmer responding (all breeds)
(iii) Number of ShikaBrown owned by the farmer responding

In addition to the household survey, aggregate data was collected on such items as national area planted, national production, producer price, composite consumer price index, average yield, in respect of the candidate crops. Furthermore, the number and quantity of eggs produced, producer price of eggs and layers productivity were some of the data collected in the aggregate.

Data analysis

Specific objectives (i) and (ii) utilized the annual average hectares of land under each variety, and the average number of ShikaBrown layers kept by farmers per annum, respectively. Specific objective (iii) was achieved by computing the hectares under each variety as a proportion of the total hectares under the crop for each household. For the ShikaBrown layers, adoption rate in each year was computed as the proportion of ShikaBrown in the total number of layers (all breeds) kept by each farmer in the sample.

We used a hybrid of the Willam Masters (1996) and Akino-Hayami (1975) models for computing the social gains and distribution among the producers and consumers for each candidate commodity. For crops like Okra that included a local variety, the cumulative yield gain was computed in the relevant years relative to the local variety. For crops like Rice that diffused first among the upland and lowland varieties captured by the survey. Relative to the base varieties, the following intermediate computations were carried out:

For varieties V1, V2, V3, V4, assume the corresponding annual yields (on-station or on-farm) are Y1, Y2, Y3 and Y4, respectively. Then, dY2, dY3, and dY4 (the yield gains) for the relevant years are:

$dY2=Y2-Y1$

$dY3=Y3-Y2$

$dY4=Y4-Y3$

For the relevant years, the cumulative yield gains are dY2, dY2+dY3, and dY2+dY3+dY4, respectively. Then, the proportional increase in yield appropriate to each of the non-base varieties (j_k; k=2,3,4) is computed as:

Variety V2: dY2.t2/Ym = j2

Variety V3: (dY2+dY3).t3/Ym = j3

Variety V4: (dY2+dY3+dY4).t4/Ym = j4

where Ym is the aggregate annual yield for the relevant commodity, and t_k (k=2,3,4) is the adoption rate in a particular year. For each relevant year, parameter j (total) = j2 + j3 + j4 (assuming only four varieties of crop). With parameter j obtained using the William Masters steps, and assuming autarky and competitive equilibrium, the j parameter assumed to approximate the k parameter in the Akino-Hayami model. These assumptions enabled the following computations (on annual basis) of the changes in consumer surplus (dCS), producer surplus (dPS) and social gains (dSG), respectively:

$$dCS \cong (0.5*P*Q*h*h)(\gamma+\eta)^{-1} + (P.Q.h.)(\gamma+\eta)^{-1}[1 - (0.5\,h.\,\eta)(\gamma+\eta)^{-1} - 0.5h]$$

$$dPS \cong j.P.Q - (P.Q.h.)(\gamma+\eta)^{-1}[1 - (0.5\,h.\,\eta)(\gamma+\eta)^{-1} - 0.5\,h]$$

$$dSG \cong (0.5*P*Q*h*h)(\gamma+\eta)^{-1} + j.P.Q$$

$$h \cong (1+\gamma)j$$

In the preceding formulas, Q is the aggregate production, P is the real producer price, j is as obtained in the WM model, γ is supply elasticity, η is demand elasticity.

Limitations of study

The key limitations of the study relates to the quality of the various data sets. The aggregate time series data were obtained from the various major sources which are hardly comparable between agencies in any given year. The exercise of asking farmers to recollect the hectares under each variety or the number of different poultry layers kept over a 19-year period was extremely ambitious. However, averaging the annual responses across the sample of respondents in each year might have smoothened out the memory errors that would have been inherent in individual responses.

Results and Discussion

Brief description of the technologies

Cowpea (IAR)

Three cowpea varieties, SAMPEA 6, SAMPEA 8 and SAMPEA 10, developed by IAR Samaru, were included in the study. The varieties were released, respectively in 1978/79, 2005 and 2008.

Details relating to their adaptation, yield potentials, and resistance to diseases, pests and weeds are presented in Table 1.

Sorghum

Four Sorghum varieties, developed by IAR Samaru, namely SAMSORG 38, SAMSORG 39, SAMSORG 40, SAMSORG 41, were studied. They were all released in the year 1996. Details relating to their yield potentials and ecological adaptation are presented in Table 2.

Cowpea (IAR & T)

One local variety (Abeweja) and two improved varieties were nominated for the study by IAR & T, Ibadan. The Ife Brown variety was released in 1970 but registered in 1990. Ife Bimpe was released in 1985 but registered in 1991. Details relating to conditions favouring adoption of the varieties are presented in Table 3.

Cassava

One local and two improved varieties, developed by IITA, Ibadan and NRCRI, Umudike, namely TMS 30572 and NR 8082, were included in the study. TMS 30572 was released in 1990 while NR 8082 was released in 1998. Some of the conditions favouring adoption of the varieties are presented in Table 4.

Okra

The Okra varieties studied are Jokoso (local), NHAe 47-4 and LD-88. The latter two were developed by NIHORT and released in 1985 and 1997, respectively. The conditions favouring adoption of the improved varieties are presented in Table 5.

Rice

Two lowland rice varieties (FARO 44 and FARO 52) and three upland varieties (FARO 46, FARO 48 and FARO 55), were studied. Available information suggests that all these varieties were bred by IITA, Ibadan, while the adaptability tests were performed by NCRI. FARO 44, FARO 46, and FARO 48 were released in 1992, while FARO 52 and FARO 55 were released in 2001 and 2003, respectively. Additional details relating to the five rice varieties are presented in Tables 6 and 7.

ShikaBrown layers

ShikaBrown is the breed of layers developed by NAPRI during the 1985-1999 period and released in 2000. Although ShikaBrown was the primary focus of the survey, other layers breeds

were also found with the farmers, namely Anak, ECWA and Black Harco. The history of development and desirable features of the ShikaBrown layers are presented in Table 8.

Table 1: Brief description of the Cowpea varieties studied

Name & Location of NARI:IAR Samaru

Name of commodity: Cowpea

	Variety 1	Variety 2	Variety 3
Year released	1978/79	2005	2008
Scientific / Technical name	SAMPEA 6	SAMPEA 8	SAMPEA 10
Local name if known			
History of technology development/research:	Developed through single plant selection from a land race, Sir Ubu	Developed by pedigree method from the cross involving lines IT86D-782 and IT90K-76, F6 line bulk-harvested in 1993 and tested in different trials at Ibadan, Kano and elsewhere in subsequent years.	Developed by pedigree method from a cross involving lines IT93K-596-9.12 and IT93K-2046-1.
Description of parameters/qualities:	Long pod, extra long seed, high yield and good palatability	Resistant to major diseases like brown blotch, scab, anthracnose, etc., non-shattering, good seed quality even if it matures during the rainy season. Extra early maturity (60-65 days).	Resistance to Striga and Alectra, and major diseases; moderately resistant to thrips and aphids. Photoperiod: insensitive with non-shattering pods
Conditions favouring adoption	Adaptation: Sudan and Sahel savanna, good palatability, extra long pod and seeds, 1.3 mt/ha	Adaptation: all Nigeria ecologies but best in the Savannas; extra early maturity (60-65 days); field resistance to pests and diseases, grain yield 2.0 mt/ha, fodder yield 1.5 mt/ha	Adaptation: the Savannas, early maturing, resistant to Striga and Alectra; yield potentials (a) grain- 2.5 mt/ha, (b) fodder- 1.5 mt/ha

Table 2: Brief description of the Sorghum varieties studied

Name & Location of NARI: IAR

Name of commodity: Sorghum

	Variety 1	Variety 2	Variety 3	Variety 4
Year released	1996	1996	1996	1996
Scientific / Technical name	SAMSORG 38	SAMSORG 39	SAMSORG 40	SAMSORG 41
Local name if known				
History of technology development/research:	Selection from Germplasm	Selection from Germplasm	Selection from Germplasm	Selection from Germplasm
Description of parameters/qualities:	Plant height, days to 50% heading, panicle length, panicle size, grain colour, grain weight, malting quality	Plant height, days to 50% heading, panicle length, panicle size, grain colour, grain weight, malting quality	Plant height, days to 50% heading, panicle length, panicle size, grain colour, grain weight, malting quality	Plant height, days to 50% heading, panicle length, panicle size, grain colour, grain weight, malting quality
Conditions favouring adoption	Early maturity and good yield, 2-2.5 mt/ha, Guinea/ Sudan Savanna ecologies	Early maturity and good yield, 2-2.5 mt/ha, Guinea/ Sudan Savanna ecologies	Early maturity and good yield, 2-2.5 mt/ha, Guinea/ Sudan Savanna ecologies	Early maturity and good yield, 2-2.5 mt/ha, Guinea/ Sudan Savanna ecologies

Table 3: Brief description of the Cowpea varieties studied

Name & Location of NARI: IAR & T, Ibadan

Name of commodity: Cowpea

	Local variety	Variety 1	Variety 2
Year released		1970, but registered in 1990	1985 but registered in 1991
Scientific / Technical name		Ife brown	Ife branching peduncle cowpea (Ife BPC)
Local name if known	Abeweja	Iranwo	Ife Bimpe
History of technology development/research:	Local variety common among farmers in the Oke Ogun area of Oyo state	Ife brown was developed from the cross involving Westbred and a local variety. It is a semi erect plant with upright podding habit held well above the canopy of the leaves	Ife BPC is a mutant strain of Ife Brown. It is unique in having branched peduncle capable of carrying more pods than other cowpea varieties.
Description of parameters/qualities:	White coloured and medium sized grains.	It is a semi erect plant with upright podding habit held well above the canopy of the leaves. It is daylight neutral.	It has branched peduncle capable of carrying more pods than other cowpea varieties.
Conditions favouring adoption	Indigenous to the area	High yield, daylight neutral, podding habit and appealing brown colour.	Higher number of pods per peduncle, high yield and daylight neutral.

Table 4: Brief description of the Cassava varieties studied

Name & Location of NARI: NRCRI, Umudike

Name of commodity: Cassava

	Local variety	Variety 1	Variety 2
Year released		1990	1998
Scientific / Technical name		TMS 30572	NR 8082
Local name if known	Nwaibibi		
History of technology development/research:	Often used as check in most varietal trials. Has proved record of early maturing and good yields, despite being susceptible to most pests and diseases of Cassava.	Developed by IITA and NRCRI in 1990. Bred basically to improve yield, and resist pests and diseases. Highly adaptable to most ecologies in Nigeria.	Developed by NRCRI only and released in 1998. Targeted at improving yield and resistance to pests and diseases. Notable for high branching and widely adaptable to various ecologies.
Description of parameters/qualities:	Profuse canopy, susceptible to pests and diseases, narrow ecological adaptation, high HCN	Profuse branching, profuse canopy, wide ecological adaptation, moderate pests and disease tolerance, high HCN, large roots, stumpy and long stems.	Profuse branching, profuse canopy, wide ecological adaptation, moderate HCN, cluster of large roots.
Conditions favouring adoption	Survives and thrives in harsh environment, early maturing.	Wide adaptation, high yielding, very good Gari quality, pest and disease resistant.	Wide adaptation, high yielding, very good Gari quality, very good stem multiplication.

Table 5 Brief description of the Okra varieties studied

Name & Location of NARI: NIHORT

Name of commodity: Okra

	Local variety	Variety 1	Variety 2
Year released		1985	1997
Scientific / Technical name		NHAe 47-4	LD-88
Local name if known	Jokoso		
History of technology development/research:		The original source is Ilorin	Bred by NIHORT
Description of parameters/qualities:		It is outstanding in terms of fruit number and weight (11.7g). Good draw quality. Tolerant to root knot nematode and viral disease and resistant to virus infection. Open pollinated pure line, short growing height (45cm), early flowering (40-50 days), stout deep green, spiny fruits. Expected yield 2-3 mt/ha. Suitable for rain forest and derived savanna.	Open pollinated pure line. Tall plant (1.5m), medium maturing (50-66 days) to flowering. Tolerant to leaf curl mosaic virus. Deep green smooth fruits with good draw quality. Average fruit weight is 1.2g. Suitable for rain forest and derived Savanna.
Conditions favouring adoption		High yielding, early maturing, deep green colour, high drawing ability and high market value.	High yielding, early maturing, good draw quality and smooth fruits that makes harvesting easy. Fruits suitable for export.

Table 6: Brief description of the Lowland rice varieties studied

Name & Location of NARI: NCRI, Badeggi

Name of commodity : Rice (Lowland)

	Variety 1-FARO 44	Variety 2- FARO 52
Year released	1992	2001
Scientific / Technical name	SIPI 692033	TOX 3100-44-12-3-3
Local name if known	SIPI	WITA 4
History of technology development/research:	Cane from Inger Africa. SIPI 661044 was crossed with 65/020	Line tested in Edozhigi and other places for Iron toxicity with IITA. It was bred by IITA observational trial advance yield trial to CRET and on-farm.
Description of parameters/qualities:	Medium grain type; growth duration is 120-135 days; early maturing , has good taste, easy to thresh, good grain quality; cooks well and does not stick.	Early maturing grain, growth duration is short 125-130 days; high yield potential 7 mt/ha
Conditions favouring adoption	Availability of water; high yield 4-8 mt/ha	Tolerant to Iron toxicity

Table 7: Brief description of the Upland rice varieties studied

Name & Location of NARI: NCRI, Badeggi

Name of commodity: Rice (Upland)

	Variety 1-FARO 46	Variety 2-FARO 48	Variety 3-FARO 55
Year released	1992	1992	2003
Scientific / Technical name	ITA 150	ITA 301	WAB 450-1-B-P38-HB
Local name if known			
History of technology development/research:	63-83//Durado* Precoce//89/ROK 1/Se 363 G** * / two parents **// three parents	ITA 13/Durado 68911 Padipa Yak	ITA 13/Durado 689/1 padipayak
Description of parameters/qualities:	Short growth duration of 100-105 days, grain type B. Potential yield 2-3.5 mt/ha	Short duration 100-105 days, grain type B, yield potential 2-5.5 mt/ha	Pro-poor rice varieties with minimum input. It yields higher than other improved rice varieties.
Conditions favouring adoption			Early maturity, suppresses weed.

Note: All the rice varieties were bred by IITA and WARDA, while the adaptability tests were performed by NCRI.

Table 8: Brief description of the ShikaBrown layers

Date lines	History of breed development	Desirable features (farmers' responses)
Research period: 1985-1999 Year of breed release: 2000	In 1985 a total of 1,411 day old grandparent stock was imported by NAPRI. The sire line was golden brown in colour while the dam line has white or silvery plumage. These were mated within each line coupled with rigorous selection for productive traits such as egg number, survivability and hardiness to disease infestation. The high genetic gain from 1985 to 1999 led to the release of the ShikaBrown poultry breed in 2000. The bird has been tested in the six geopolitical zones of the country and found adaptable in all parts of Nigeria.	- Short maturity period - High egg production - Hardiness of the bird - High resistance to most poultry diseases - Adaptation to wide range of environment - Long period of laying - High body weight at old age - Peak production about 85% - Egg size 50-60 g - High market value of bird even at old age

Annual average areas under the technologies

As indicated under the methodology section, farmers were asked to estimate the areas planted to the different varieties of the crops under study during the relevant years. In this section, we present the average area under each variety of the relevant crop on annual basis.

Okra

From Table 9, during the 1997-2008 period, the average area under the local, NHA e 47-4 and LD-88 varieties of Okra were 0.99ha, 0.28ha and 0.96ha, respectively. And, as illustrated further in Fig 1, the local and LD-88 varieties maintained stronger presence with the farmers during the period under review.

Cowpea (IAR)

Table 10 shows the annual areas under SAMPEA 6 and SAMPEA 8 varieties. SAMPEA 10 was released in 2008 and no data was available on it at survey time. During the 1996-2008 period the farmers grew an average of 0.78ha of SAMPEA 6 and an average of 0.66 ha per annum of SAMPEA 8 during the 2005-2008 period. Fig 2 provides an illustrative support to Table 10.

Sorghum

From Table 11, the average areas under SAMSORG 38, SAMSORG 39, SAMSORG 40 and SAMSORG 41 during the 1997-2008 period were 1.01 ha, 0.64 ha, 0.43 ha and 1.47 ha, respectively. Fig 3 shows that all four varieties increased in area over time during the period under review.

Cowpea (IAR & T)

Table 12 shows that on the average farmers grew 0.065 ha of the local variety during the 1990-2008 period. However, in apparent abandonment of the local variety (Abeweja), the farmers in the survey grew an average of 1.14 ha of Ife Brown during the same period. As shown in Fig 4, the trend in the area planted the improved Ife Bimpe is not too different from the local variety during the period under review.

Cassava

Table 13 shows that farmers in the survey grew, on the average, 0.79 ha of TMS 30372 during the 1991-2008 period and 1.25 ha of NR 8082 during the 1998-2008 period. Fig 5 clearly suggests that more areas of land might have shifted towards the NR 8082 variety at the expense of TMS 30572 during the 2001-2008 period.

Rice

In Table 14, farmers planted FARO 44, FARO 52, FARO 46, FARO 48 and FARO 55 at annual averages of 2.33 ha, 1.95 ha, 0.49 ha, 0.33 ha and 1.27 ha, respectively during the relevant adoption periods. The two lowland varieties (FARO 44 and FARO 52) and one of the upland varieties (FARO 55) appeared to have increased the areas planted to them between 2000 and 2008 at the expense of upland varieties FARO 46 and FARO 48 (see Fig 6).

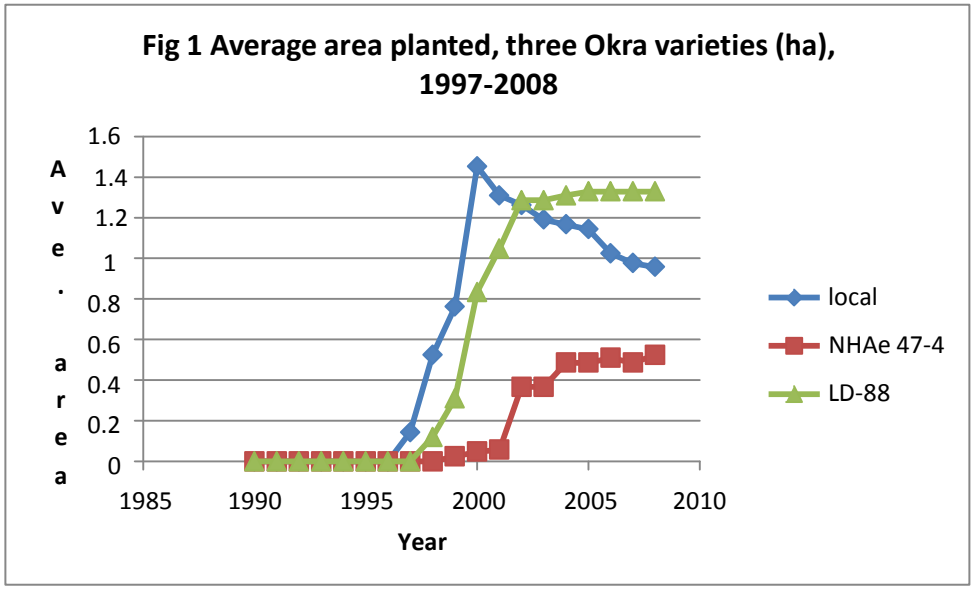
Annual average size of ShikaBrown layers technology

Table 15 and Fig 7 show the average number of Shikabrown layers kept by respondents per annum between 1990 and 2008. Although ShikaBrown was released in 2000, farmers appeared to have got access to the breed earlier, possibly on trial basis. Fig 7 shows a non-consistent increase in the average number of birds kept per annum from 1990 to 2005.

NIHORT

Table 9: Average area planted, three Okra varieties (ha), 1997-2008

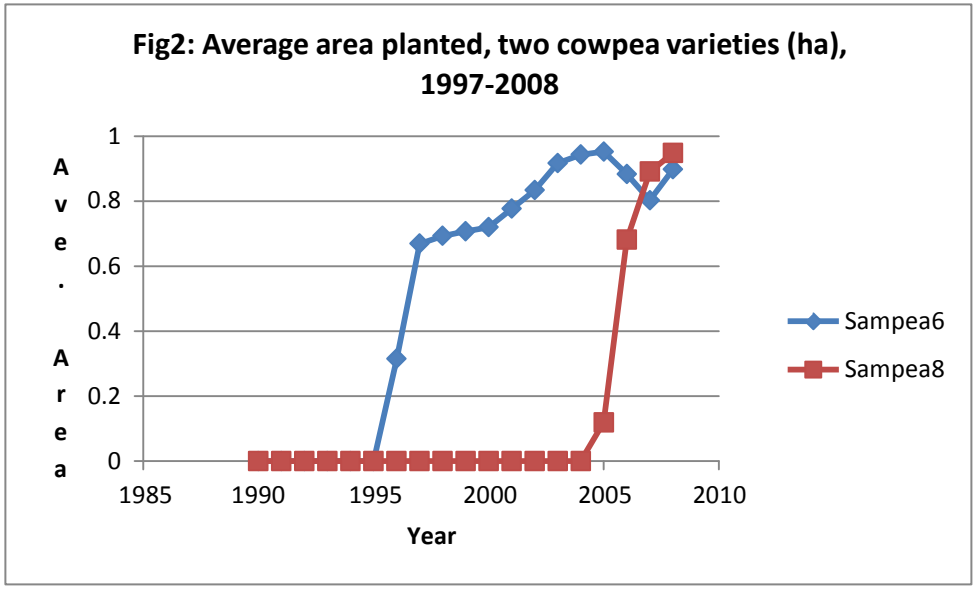
Year	local	NHAe 47-4	LD-88
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0.142857	0	0
1998	0.52381	0	0.119048
1999	0.761905	0.02381	0.309524
2000	1.452381	0.047619	0.833333
2001	1.309524	0.057143	1.047619
2002	1.261905	0.366667	1.285714
2003	1.190476	0.366667	1.285714
2004	1.166667	0.485714	1.309524
2005	1.142857	0.485714	1.328571
2006	1.02381	0.509524	1.328571
2007	0.97619	0.485714	1.328571
2008	0.957143	0.52381	1.328571



IAR

Table 10: Average area planted, two cowpea varieties (ha), 1997-2008

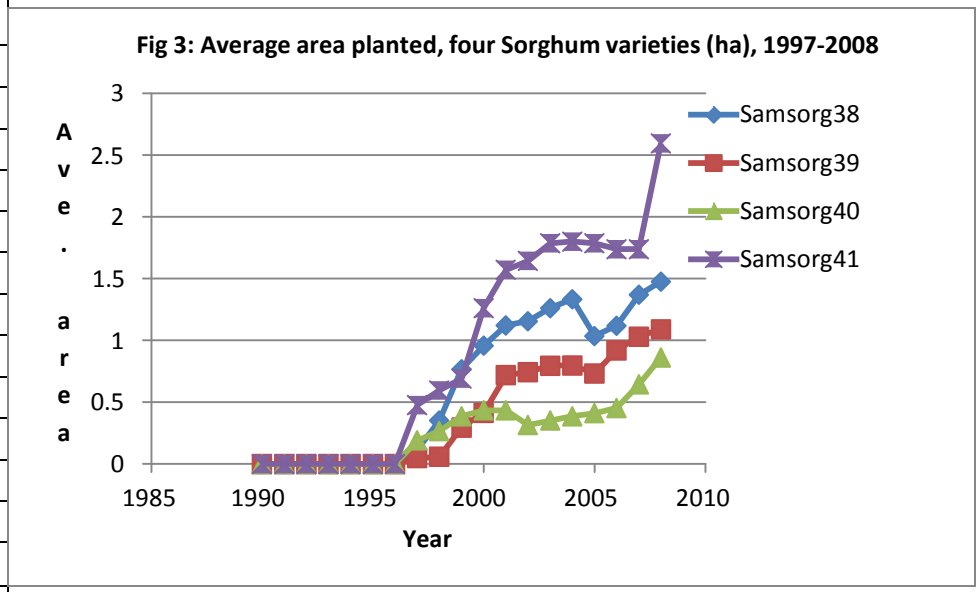
Year	Sampea6	Sampea8
1990	0	0
1991	0	0
1992	0	0
1993	0	0
1994	0	0
1995	0	0
1996	0.314286	0
1997	0.669048	0
1998	0.692857	0
1999	0.707143	0
2000	0.719048	0
2001	0.77619	0
2002	0.833333	0
2003	0.916667	0
2004	0.942857	0
2005	0.952381	0.119048
2006	0.883333	0.680952
2007	0.802381	0.890476
2008	0.897619	0.947619



IAR

Table 11: Average area planted, four Sorghum varieties (ha), 1997-2008

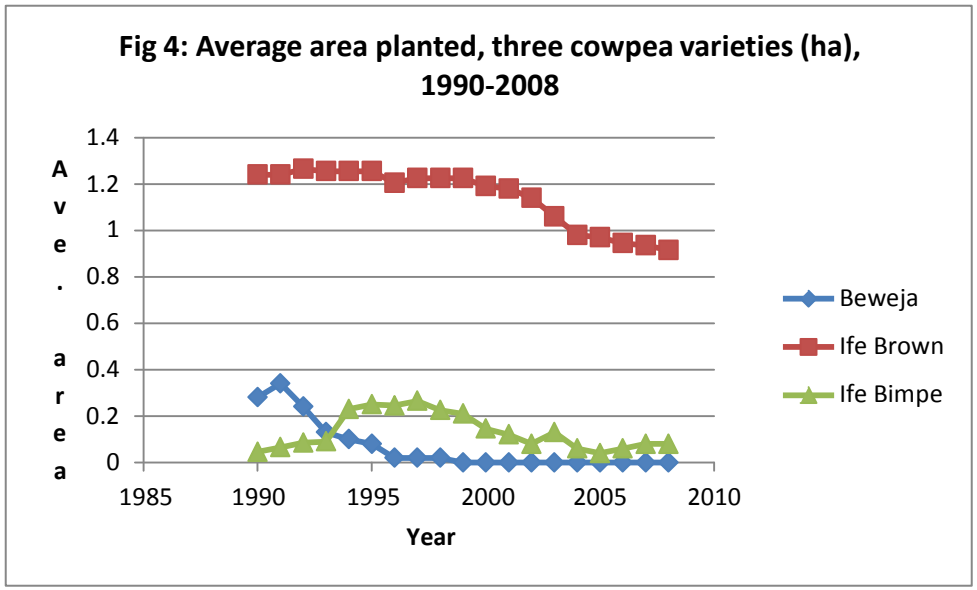
Year	Samsorg38	Samsorg39	Samsorg40	Samsorg41
1990	0	0	0	0
1991	0	0	0	0
1992	0	0	0	0
1993	0	0	0	0
1994	0	0	0	0
1995	0	0	0	0
1996	0	0	0	0
1997	0.114286	0.047619	0.190476	0.47619
1998	0.352381	0.057143	0.266667	0.595238
1999	0.766667	0.295238	0.385714	0.690476
2000	0.957143	0.414286	0.433333	1.261905
2001	1.121429	0.719048	0.433333	1.571429
2002	1.154762	0.742857	0.314286	1.642857
2003	1.261905	0.795238	0.35	1.785714
2004	1.333333	0.797619	0.385714	1.8
2005	1.035714	0.733333	0.409524	1.785714
2006	1.119048	0.919048	0.452381	1.738095
2007	1.369048	1.030952	0.642857	1.738095
2008	1.47619	1.090476	0.861905	2.595238



IAR&T

Table 12: Average area planted, three cowpea varieties (ha), 1990-2008

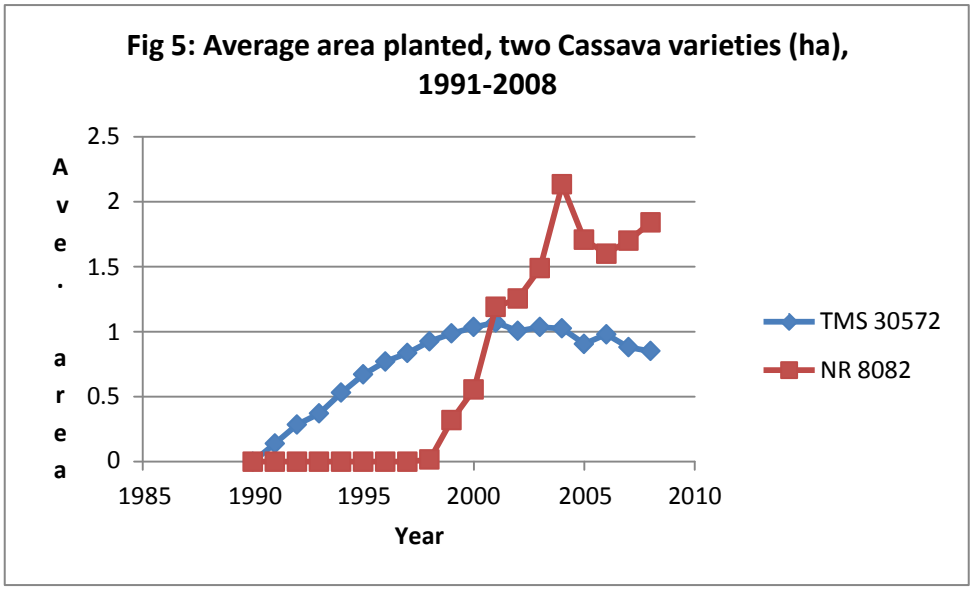
Year	Beweja	Ife Brown	Ife Bimpe
1990	0.28	1.24	0.045
1991	0.34	1.24	0.065
1992	0.24	1.265	0.085
1993	0.13	1.255	0.09
1994	0.1	1.255	0.23
1995	0.08	1.255	0.25
1996	0.02	1.205	0.245
1997	0.02	1.225	0.265
1998	0.02	1.225	0.225
1999	0	1.225	0.21
2000	0	1.19	0.145
2001	0	1.18	0.12
2002	0	1.14	0.08
2003	0	1.06	0.13
2004	0	0.98	0.06
2005	0	0.97	0.04
2006	0	0.945	0.06
2007	0	0.935	0.08
2008	0	0.915	0.08



NRCRI

Table 13: Average area planted, two Cassava varieties (ha), 1991-2008

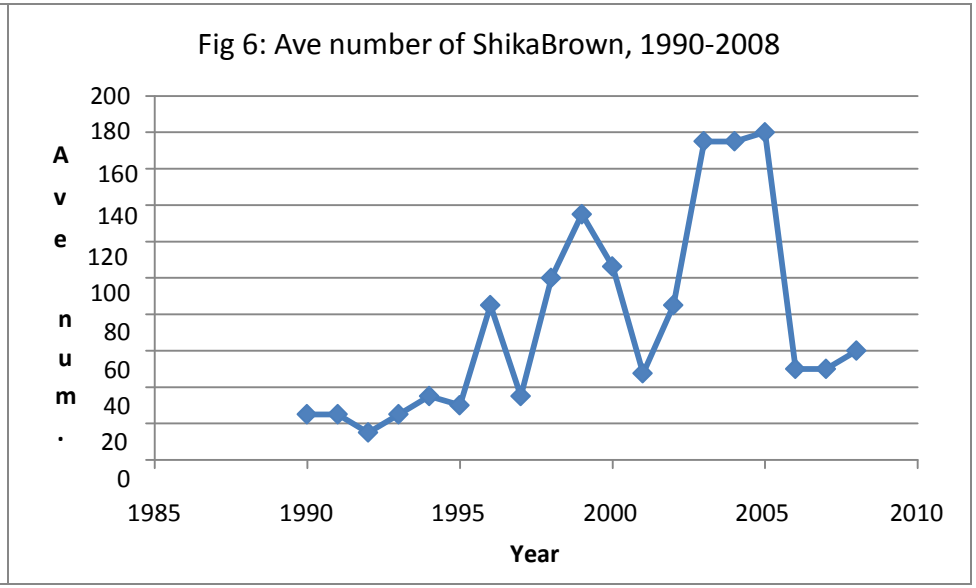
Year	TMS 30572	NR 8082
1990	0	0
1991	0.14	0
1992	0.285	0
1993	0.37	0
1994	0.53	0
1995	0.67	0
1996	0.77	0
1997	0.835	0
1998	0.925	0.015
1999	0.985	0.32
2000	1.035	0.555
2001	1.07	1.19
2002	1.005	1.255
2003	1.035	1.4875
2004	1.025	2.1325
2005	0.905	1.7075
2006	0.98	1.6
2007	0.88	1.7
2008	0.85	1.84



NAPRI

Table 14: Ave number of ShikaBrown, 1990-2008

Year	Ave number
1990	25
1991	25
1992	15
1993	25
1994	35
1995	30
1996	85
1997	35
1998	100
1999	135
2000	106.25
2001	47.5
2002	85
2003	175
2004	175
2005	180
2006	50
2007	50
2008	60



Trends in technology adoption rates

In this section the technology adoption rates are presented on annual basis for the relevant portions of the study period (1990-2008). Except for a few cases of pre-release on-farm trials, most of the adoption rates presented typically post-dates the technology release years.

Okra

Table 16 and Fig 8 presents the annual adoption rates of the local and two improved Okra varieties during the 1997-2008 period. During this period, the mean adoption rates for the local, NHA e 47-4 and LD-88 varieties were 52.9%, 9.9% and 37.1%, respectively. Adoption rates dropped over time for the local variety and improved notably for LD-88 and mildly for NHA e 47-4.

Cowpea (IAR)

The mean adoption rates for SAMPEA 6 during the 1996-2008 period is 87.8% and 12.2% for SAMPEA 8 during the 2005-2008 period. The adoption of SAMPEA 8 trended positively since its release in 2005, at the expense of SAMPEA 6. See Table 17 and Fig 9.

Sorghum

Adoption rates were computed for varieties of Sorghum and presented in Table 18 and Fig 10, respectively. The mean adoption rates for SAMSORG 38, SAMSORG 39, SAMSORG 40 and SAMSORG 41 are 27.9%, 16.1%, 13.5% and 42.6%, respectively during the 1997-2008 period. During the post-2000 period SAMSORG 41 showed the best adoption rates while SAMSORG 40 showed the least. Thus varietal development over time may not have kept pace with farmers' preferences among the varieties released.

Cowpea (IAR & T)

The adoption rates for the local and two improved IAR &T Cowpea varieties are presented in Table 19 and Fig 11, respectively. The mean adoption rates during the 1990-2008 period for the local, Ife Brown and Ife Bimpe varieties were 4.1%, 86.3% and 9.6%. While the local variety (Abeweja) dropped out after 1998, Ife Brown consistently stood out in terms of preference among the three varieties studied.

Cassava

Table 20 and Fig 12 presents the adoption rates for the two improved varieties of Cassava, TMS 30572 and NR 8082, during the 1991-2008 period. The mean adoption rates for TMS 30572 and NR 8082 during the period were 69% and 31%, respectively. The adoption of TMS 30572 dropped off significantly relative to NR 8082, after 2000.

Rice

During the 1992-2008 period the mean adoption rates for rice varieties FARO 44, FARO 46, FARO 48, FARO 52 and FARO 55 are 59.4%, 12.8%, 7.9%, 13.8%, and 6.2%, respectively. Adoption rates for FARO 44 dropped off steadily over time while those for FARO 52 and FARO 55 rose after year 2000 (see Table 21 and especially Fig 13).

Adoption rates for ShikaBrown layers

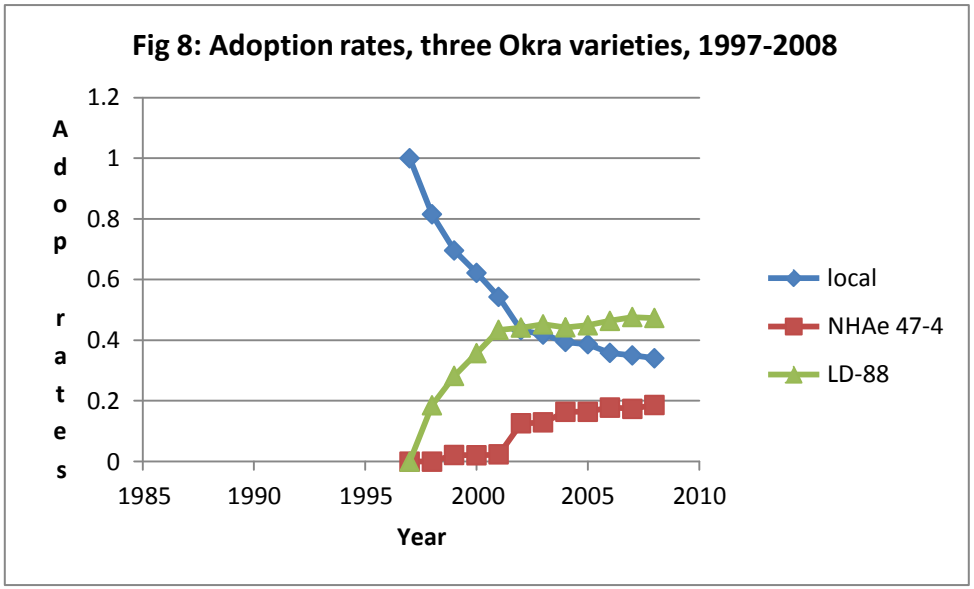
The adoption behavior for ShikaBrown layers was analyzed under three regimes. These are (a) the proportion of ShikaBrown layers in the total number of layers found with farmers, (b) the proportion of farmers adopting ShikaBrown layers in each of the years under review and the proportion of farmers adopting ShikaBrown layers first-time in a given year.

In Table 22, which depicts our preferred measure of Shikabrown adoption rates, the mean adoption rate during the 1990-2008 period is 86.7%. Perhaps due to the discrete nature of the poultry data the adoption rate series consists of jumps between years. So, no clear trend is indicated in Fig 14. The measure of adoption rates in terms of the proportion of farmers keeping ShikaBrown each year is presented in Table 23 and Fig 15. Table 24 and Fig 16 shows the proportion of the farmers adopting ShikaBrown for the first time in the years indicated. The results in Tables 22-24 suggests that the ShikaBrown birds might have been with the farmers earlier than the year of official release (2000). Furthermore, this suggestion assumes further that the farmers in the survey clearly knew the difference between ShikaBrown and other layers.

NIHORT

Table 16: Adoption rates, three Okra varieties, 1997-2008

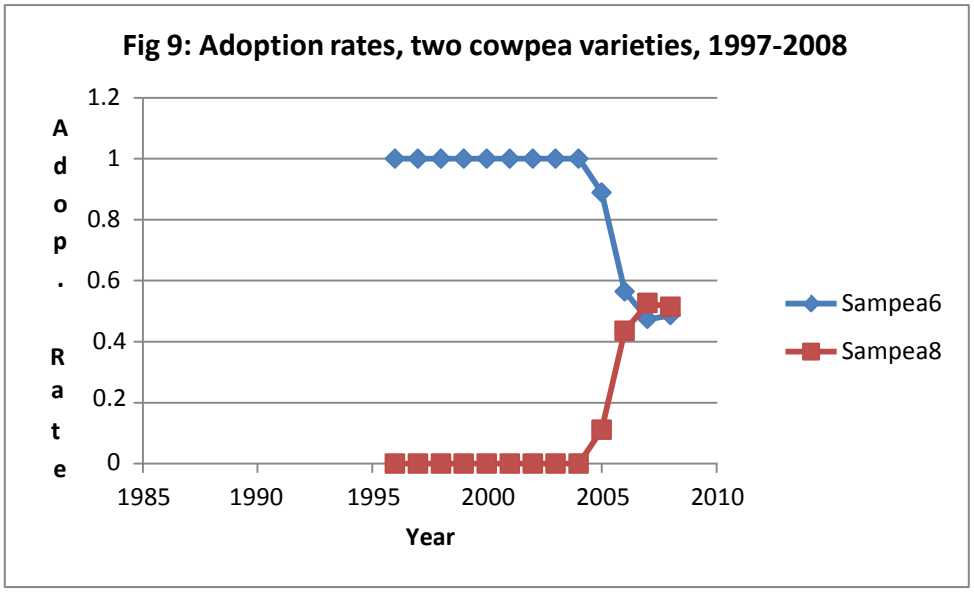
Year	local	NHAe 47-4	LD-88
1990			
1991			
1992			
1993			
1994			
1995			
1996			
1997	1	0	0
1998	0.814815	0	0.185185
1999	0.695652	0.021739	0.282609
2000	0.622449	0.020408	0.357143
2001	0.542406	0.023669	0.433925
2002	0.433007	0.125817	0.441176
2003	0.41876	0.128978	0.452261
2004	0.393891	0.163987	0.442122
2005	0.386473	0.164251	0.449275
2006	0.357737	0.178037	0.464226
2007	0.349829	0.174061	0.476109
2008	0.340678	0.186441	0.472881



IAR

Table 17: Adoption rates, two cowpea varieties, 1997-2008

Year	Sampea6	Sampea8
1990		
1991		
1992		
1993		
1994		
1995		
1996	1	0
1997	1	0
1998	1	0
1999	1	0
2000	1	0
2001	1	0
2002	1	0
2003	1	0
2004	1	0
2005	0.888889	0.111111
2006	0.564688	0.435312
2007	0.47398	0.52602
2008	0.486452	0.513548



IAR

Table 18: Adoption rates, four varieties of Sorghum, 1997-2008

Year	Samsorg 38	Samsorg39	Samsorg40	Samsorg41
1990				
1991				
1992				
1993				
1994				
1995				
1996				
1997	0.137931	0.057471	0.229885	0.574713
1998	0.277154	0.044944	0.209738	0.468165
1999	0.358575	0.138085	0.180401	0.32294
2000	0.312112	0.135093	0.141304	0.411491
2001	0.291641	0.186997	0.112693	0.408669
2002	0.299568	0.192712	0.081532	0.426189
2003	0.300965	0.189665	0.083475	0.425894
2004	0.30888	0.184777	0.089355	0.416988
2005	0.261261	0.184985	0.103303	0.45045
2006	0.26464	0.217342	0.106982	0.411036
2007	0.286355	0.215637	0.134462	0.363546
2008	0.245059	0.181028	0.143083	0.43083

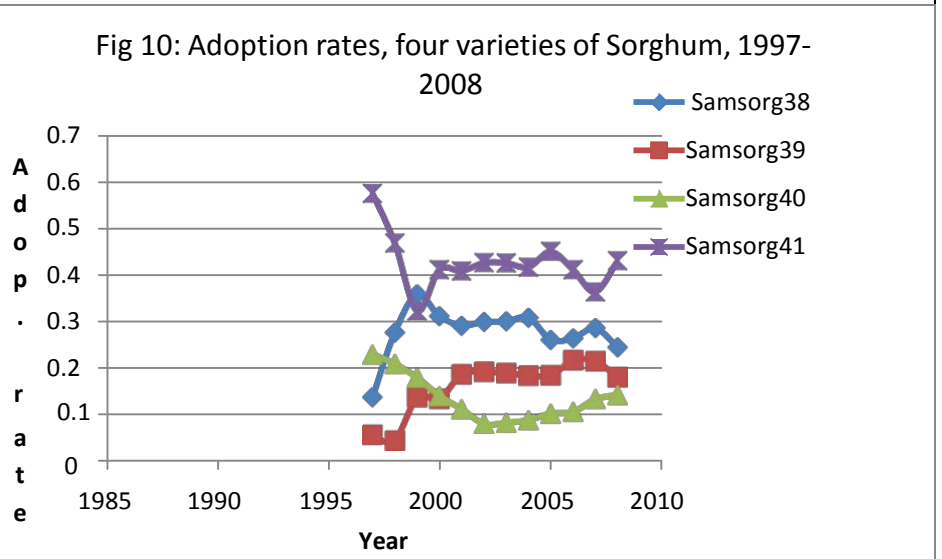


Table 19: Adoption rates, three cowpea varieties, IAR&T, 1990-2008

Year	Beweja	Ife Brown	Ife Bimpe
1990	0.178914	0.792332	0.028754
1991	0.206687	0.753799	0.039514
1992	0.150943	0.795597	0.053459
1993	0.088136	0.850847	0.061017
1994	0.063091	0.791798	0.14511
1995	0.050473	0.791798	0.157729
1996	0.013605	0.819728	0.166667
1997	0.013245	0.811258	0.175497
1998	0.013605	0.833333	0.153061
1999	0	0.853659	0.146341
2000	0	0.891386	0.108614
2001	0	0.907692	0.092308
2002	0	0.934426	0.065574
2003	0	0.890756	0.109244
2004	0	0.942308	0.057692
2005	0	0.960396	0.039604
2006	0	0.940299	0.059701
2007	0	0.921182	0.078818
2008	0	0.919598	0.080402

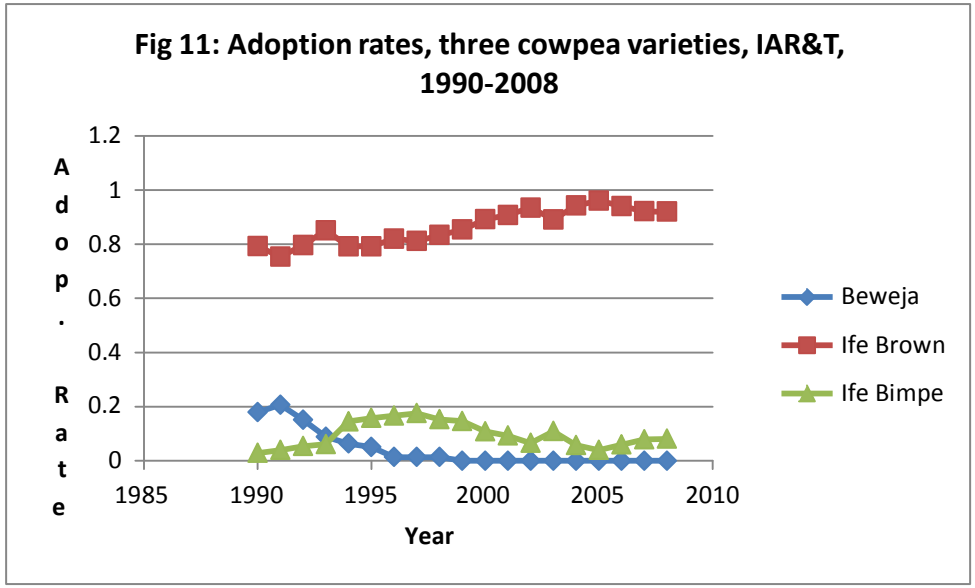


Table 20: Adoption rates, two Cassava varieties, 1991-2008

Year	TMS 30572	NR 8082
1990		
1991	1	0
1992	1	0
1993	1	0
1994	1	0
1995	1	0
1996	1	0
1997	1	0
1998	0.984043	0.015957
1999	0.754789	0.245211
2000	0.650943	0.349057
2001	0.473451	0.526549
2002	0.44469	0.55531
2003	0.410307	0.589693
2004	0.324624	0.675376
2005	0.346411	0.653589
2006	0.379845	0.620155
2007	0.341085	0.658915
2008	0.315985	0.684015

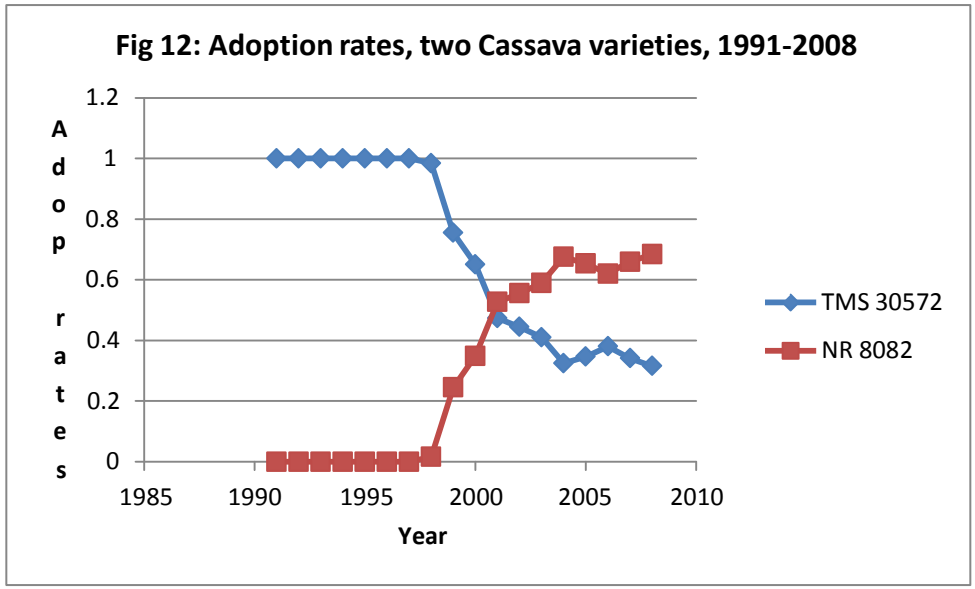


Table 21: Adoption rates, upland and lowland rice varieties, 1992-2008

Year	Faro44	Faro46	Faro48	Faro52	Faro55
1990					
1991					
1992	0.913357	0.061372	0.025271	0	0
1993	0.852853	0.111111	0.036036	0	0
1994	0.740741	0.166667	0.092593	0	0
1995	0.72381	0.161905	0.114286	0	0
1996	0.706406	0.169039	0.124555	0	0
1997	0.673367	0.20938	0.117253	0	0
1998	0.689394	0.19697	0.113636	0	0
1999	0.683824	0.205882	0.110294	0	0
2000	0.673759	0.212766	0.113475	0	0
2001	0.495	0.15	0.095	0.26	0
2002	0.481132	0.141509	0.089623	0.287736	0
2003	0.444079	0.115132	0.078125	0.296053	0.066612
2004	0.409824	0.084311	0.05132	0.296921	0.157625
2005	0.410167	0.066156	0.048747	0.292479	0.182451
2006	0.398925	0.053727	0.043653	0.298858	0.204835
2007	0.404842	0.036987	0.043712	0.302623	0.211836
2008	0.394822	0.032362	0.042071	0.304207	0.226537

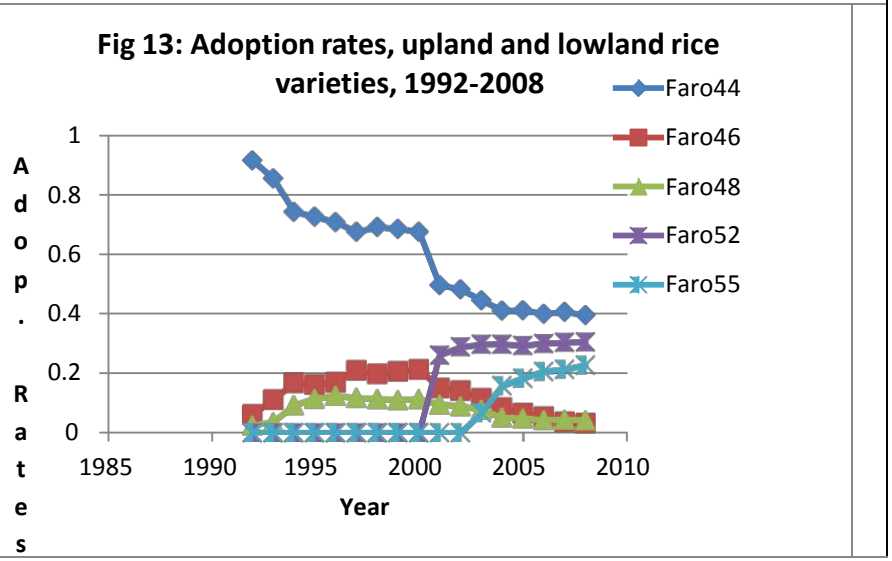


Table 22: : Proportion of ShikaBrown in total layers breeds

Year	ShikaBrown Adopt. rate
1990	1
1991	1
1992	1
1993	1
1994	0.823529
1995	1
1996	0.894737
1997	1
1998	0.784314
1999	0.5625
2000	0.744308
2001	0.655172
2002	0.772727
2003	1
2004	0.744681
2005	1
2006	0.5
2007	1
2008	1

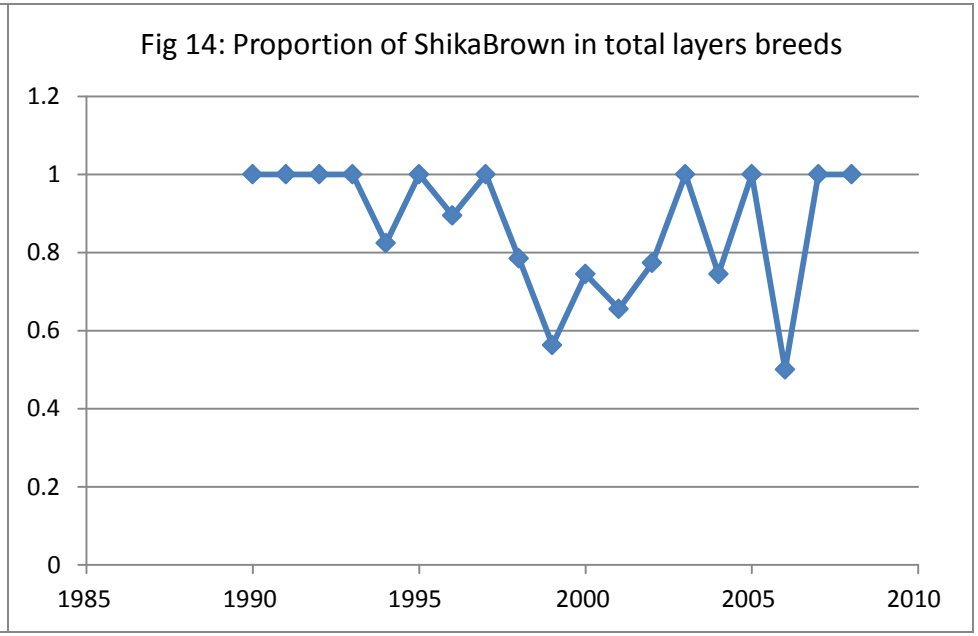


Table : Proportion of respondents adopting ShikaBrown in the year shown

Year	Proportion of respondents
1990	0.05
1991	0.05
1992	0.05
1993	0.05
1994	0.1
1995	0.05
1996	0.25
1997	0.05
1998	0.2
1999	0.1
2000	0.2
2001	0.05
2002	0.1
2003	0.25
2004	0.15
2005	0.15
2006	0.05
2007	0.05
2008	0.05

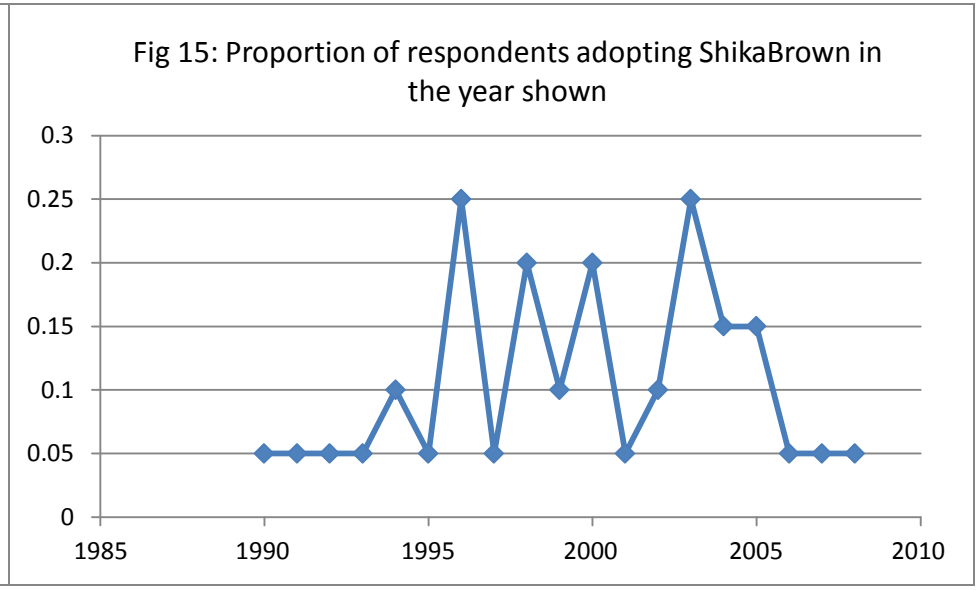
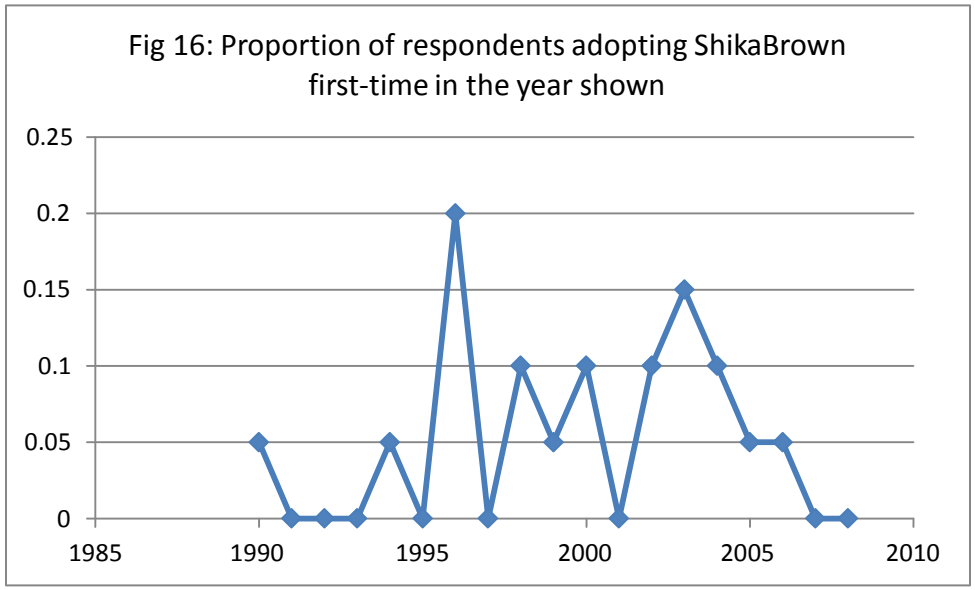


Table 24: Proportion of respondents adopting ShikaBrown first-time in the year shown

Year	Proportion of respondents
1990	0.05
1991	0
1992	0
1993	0
1994	0.05
1995	0
1996	0.2
1997	0
1998	0.1
1999	0.05
2000	0.1
2001	0
2002	0.1
2003	0.15
2004	0.1
2005	0.05
2006	0.05
2007	0
2008	0



Amount and distribution of social gains from adopting technologies

In this section we present the cumulative annual monetary gains and distributions between consumers and producers in relation to the various agricultural technologies studied. In doing the computations, we added a few more assumptions. First, we assumed that the supply of and demand for each of the commodities are price inelastic (price elasticity of supply=0.2, price elasticity of demand=0.5). Two, we assumed constant elasticity demand and supply functions, following Akino and Hayami (1975). The subsequent results derived from these assumptions along with the formulas and assumptions shown under the methodology section.

Okra

Table 25 and Fig 17 show the estimated cumulative gains and distribution during the relevant period of adopting the Okra varieties under review. On the average, consumers gained N0.882bn per annum while producers lost N0.248bn per annum from the adoption of these Okra varieties. In the aggregate, society gained N0.633bn per annum during the 1998-2008 period. That producers always gain less than consumers from technology development is a standard result when demand is price inelastic, as subsequent results in this section will also show.

Cowpea (IAR & T)

The cumulative gains and distribution relating to the adoption of IAR & T Cowpea varieties are presented in Table 26 and Fig 18. On the average, consumers gained N69.35bn per annum while producers gained N43.05bn per annum from the adoption of the Cowpea varieties under study. Society gained, on the average, N112.40bn per annum.

Rice

In Table 27 and Fig 19, we present the cumulative gains and distribution from the adoption of five rice varieties. The average, consumers gained N660.99bn per annum, while producers gained N64.09bn per annum during the 1992-2008 period. Society gained N725.08bn per annum, on the average.

Cassava

From Table 28 and Fig 20, it is computed that, on the average, the cumulative gains to consumers and loss to producers were N277.79bn and N44.77bn per annum during 1998-2008 period. The Cassava results again clearly depict the possibility of financial loss to producers when demand is price inelastic. Society, on the average, gained N233.02bn per annum during the period 1998-2008 period.

ShikaBrown layers

In the maiden (2008) edition of the economic impact assessment exercise, ShikaBrown layers were included in the study. But, the economic impact analysis could not be fulfilled for the layers breed because the crop equivalent measures of the adoption rates, yield or productivity, and proportional production increase could not be established for the poultry layers. In the present edition of the study, some tentative estimates of these quantities are derived, which enabled the results presented in Table 29 and Fig 21.

On the average, consumers gained N172.06bn per annum while producers gained N142.47bn per annum from the adoption of the ShikaBrown layers during the 1990-2008. Society, on the average, however gained N314.52bn per annum from the development and adoption of the layers breed under review. It is significant to note from Fig 21 that the gains from the ShikaBrown adoption to consumers, producers and society all fell steadily in real terms from 1990 to 2008. This could be due to a number of reasons, which might include inflationary pressure, competition from imported eggs and the lack of continuity in the ShikaBrown research to maintain its competitive edge above other rival layers breed.

Table 25: Distribution of cum social gains, Okra varieties adoption, Nbill., 1998-2008

Year	dCS	dPS	dSG
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	0.64805	-0.23655	0.411495
1999	1.758421	-0.58689	1.17153
2000	1.321966	-0.40103	0.920936
2001	0.853086	-0.24766	0.605426
2002	0.842222	-0.21529	0.626931
2003	0.738511	-0.18889	0.549622
2004	0.705086	-0.17148	0.533602
2005	0.651722	-0.1606	0.491127
2006	0.693034	-0.16408	0.528958
2007	0.801548	-0.2025	0.599052
2008	0.687717	-0.15824	0.529482

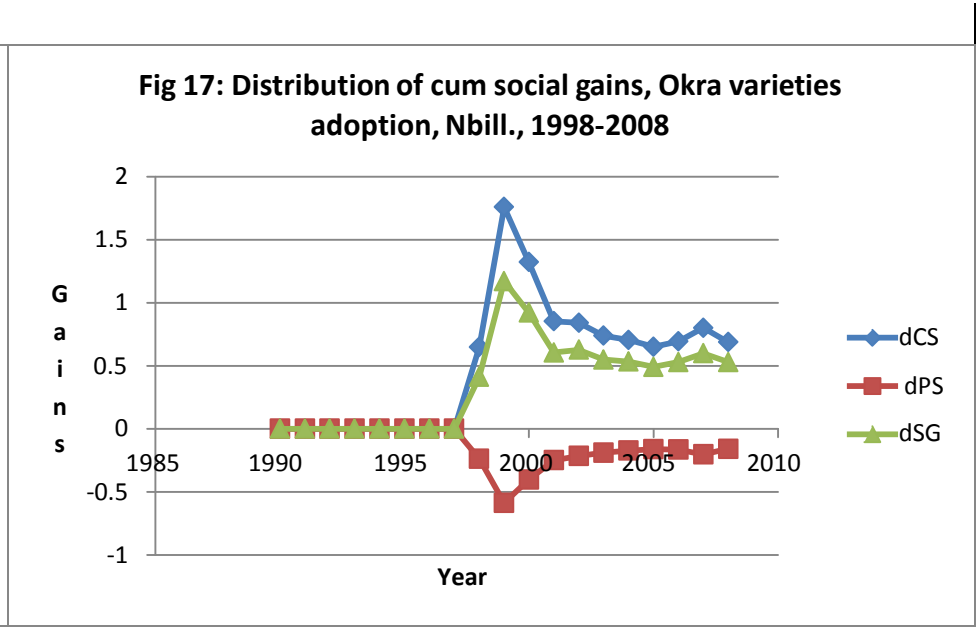


Table 26: Distribution of cum. Social gains, Cowpea varieties adoption, Nbill.,1991-2008

Year	dCS	dPS	dSG
1990	0	0	0
1991	-195.42	138.4781	-56.9419
1992	-175.688	127.5381	-48.1503
1993	82.93764	-20.6084	62.32928
1994	43.25609	-13.0149	30.24123
1995	22.81507	-7.91834	14.89674
1996	32.06676	-11.0363	21.03047
1997	27.35312	-9.40484	17.94828
1998	25.94792	-8.94279	17.00512
1999	27.82545	-9.56985	18.2556
2000	27.09529	-9.37953	17.71576
2001	50.5511	-14.4269	36.12417
2002	190.6255	113.7881	304.4136
2003	174.2568	105.0417	279.2985
2004	191.3699	114.0299	305.3998
2005	246.2813	146.1517	392.4331
2006	182.557	45.42345	227.9805
2007	146.6343	44.14418	190.7784
2008	147.8909	44.61627	192.5071

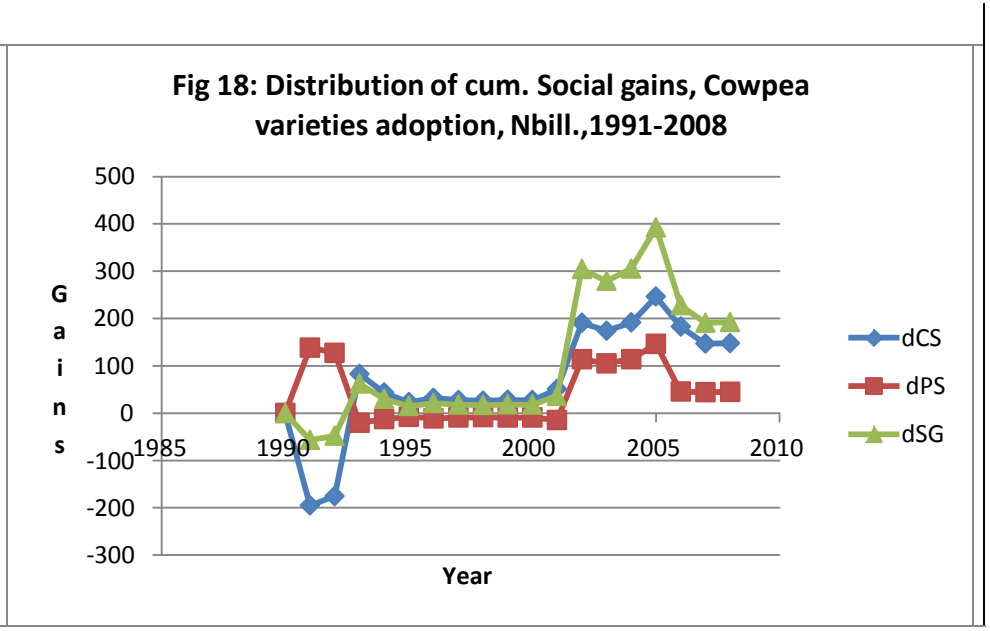


Table 27: Distribution of cum. social gains from upland and lowland rice varieties adoption, Nbill., 1992-2008

Year	dCS	dPS	dSG
1990	0	0	0
1991	0	0	0
1992	-419.491	197.5338	-221.958
1993	467.7071	-162.081	305.6258
1994	345.4176	-99.7441	245.6735
1995	271.8764	-75.9427	195.9337
1996	385.9408	-104.178	281.7624
1997	385.0355	-97.3212	287.7143
1998	426.3576	-111.433	314.9244
1999	349.5329	-90.3651	259.1679
2000	336.3101	-85.1176	251.1924
2001	1279.572	201.5196	1481.092
2002	1109.909	37.13461	1147.043
2003	747.4639	83.87172	831.3357
2004	918.1124	188.3366	1106.449
2005	1309.218	289.6355	1598.854
2006	1269.839	329.528	1599.366
2007	969.6933	267.4461	1237.139
2008	1084.314	320.6589	1404.973

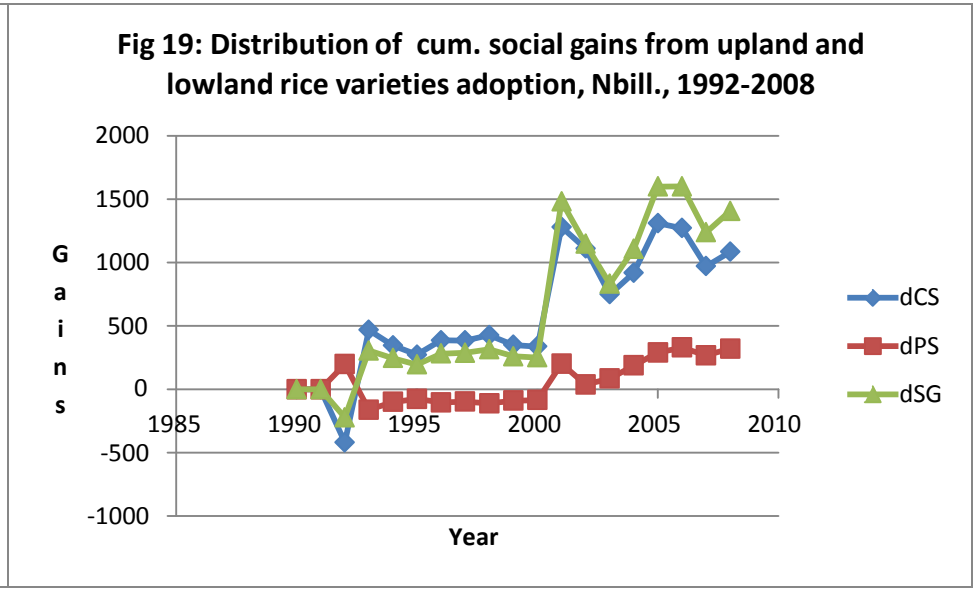


Table 28: Distribution of cum. social gains, two cassava varieties adoption, Nbill., 1998-2008

Year	dCS	dPS	dSG
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	13.08991	-5.35795	7.731967
1999	199.3884	-60.8086	138.5797
2000	204.032	-60.5951	143.4368
2001	-46.933	20.42239	-26.5106
2002	296.525	-96.9569	199.5681
2003	380.0814	-77.2242	302.8572
2004	411.5078	-44.9734	366.5344
2005	405.2445	-51.4684	353.776
2006	386.7102	-69.8928	316.8174
2007	423.2203	-29.6928	393.5275
2008	382.9051	-15.976	366.9292

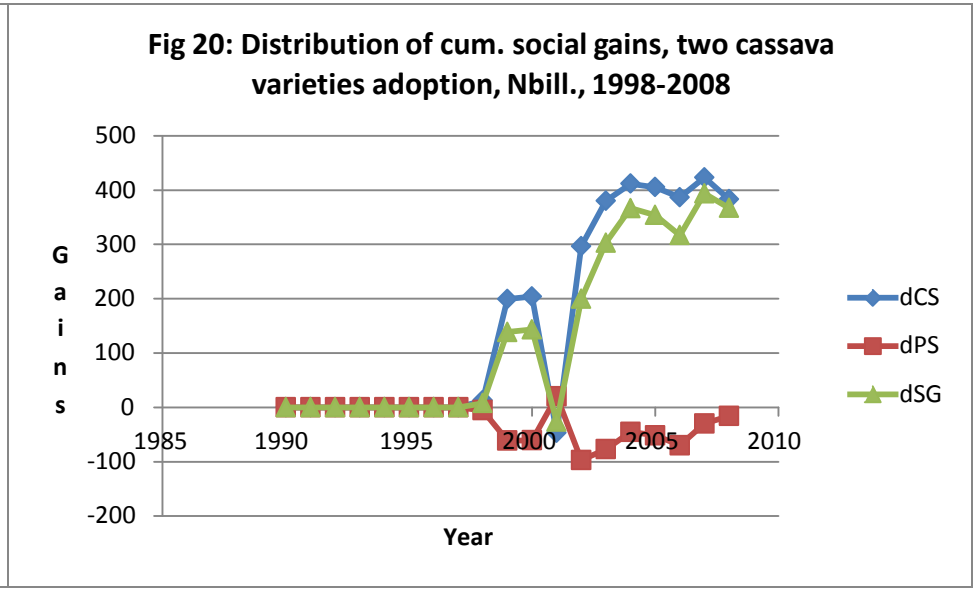
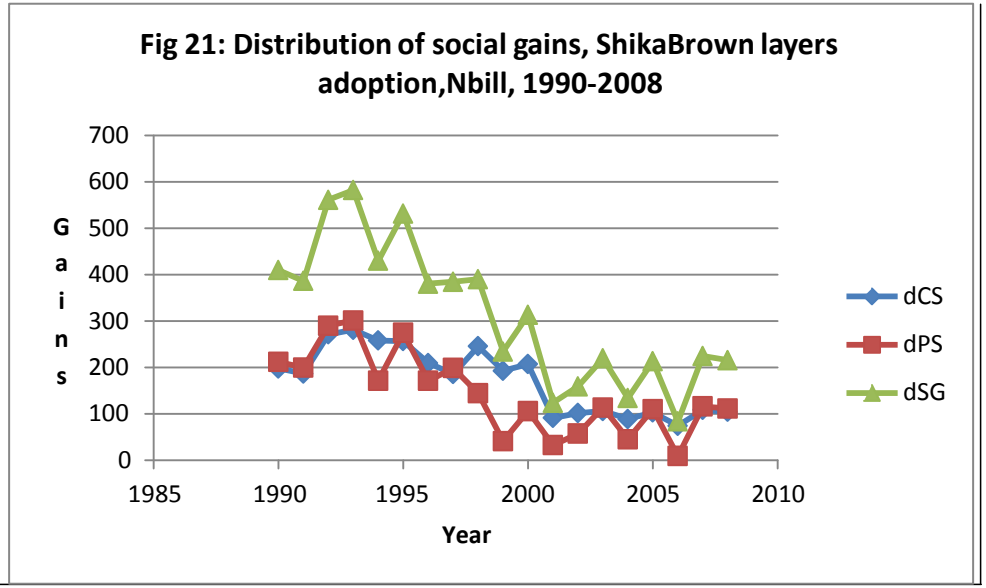


Table 29: Distribution of social gains, ShikaBrown layers adoption,Nbill, 1990-2008

Year	dCS	dPS	dSG
1990	197.8635	211.8788	409.7423
1991	186.5691	199.7844	386.3535
1992	270.9766	290.1708	561.1473
1993	281.0847	300.9948	582.0795
1994	257.9833	171.598	429.5813
1995	256.5555	274.7282	531.2837
1996	209.4508	171.094	380.5448
1997	185.7295	198.8853	384.6148
1998	245.6153	144.3119	389.9272
1999	192.9342	41.15929	234.0935
2000	207.0644	106.0869	313.1514
2001	91.23553	32.63024	123.8658
2002	101.6217	57.45408	159.0758
2003	106.0056	113.5144	219.52
2004	88.63117	45.46963	134.1008
2005	102.9574	110.2502	213.2076
2006	74.24732	9.224668	83.47199
2007	108.4244	116.1045	224.529
2008	104.1702	111.5489	215.7192



Conclusions and Recommendations

The results obtained in the foregoing sections reinforce two inevitable conclusions. One, the drop-out of the local or older improved varieties from the adoption portfolio of farmers suggests the need for continuous research towards evolving better varieties. A halt of varietal or breed improvement research could lead to loss in productivity and competiveness by the relevant commodity with the passage of time. Two, but not unique to this study only, the monetary gains from technology adoption is higher for consumers than producers under regimes of price inelastic demand and supply. This means that public investment must be assured particularly and continuously in non-traded food-based agricultural research in Nigeria, since most of the gains will ultimately end up with the consumers.

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