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Making Nigerian Agricultural Markets Work for the Poor

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Financial analysis of Improved De-stoning Technology

By

M & A Greenery, Ltd.

May 20, 2008

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Financial Analysis of Improved De-stoning Technology

Final Report Submitted to:

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Executive Summary

Rice is one of the most important staple crops in Nigeria, second to wheat in value. Local production of the commodity has been increasing over the decades. The demand for rice has also been increasing faster than production; this has made Nigeria a net importer of rice in order to meet consumers demand. Nigerian consumers have shown greater preference for the imported rice because of its high quality in terms of cleanliness. Rice quality issues have therefore become very important because existing low quality of the local rice can hinder efforts in increasing output to meet consumers demand. The major challenge lies in the development of appropriate technologies that will improve the quality of the local rice such that it can compete favourably with the imported rice.

Presence of stones in local rice is one of the factors that decreases the quality of Nigerian rice. The small Engleberg rice processing mill used by majority of rice processors in Nigeria includes a dehusking element and a polisher, but do not come with de-stoners. De stoners are found only in high tonnage integrated mills. Earlier survey conducted by M & A's Greenery Ltd revealed the availability of few imported and locally fabricated de-stoners in use by rice processors. The study also revealed that de-stoners have the potential to improve the quality of locally processed rice if information on their uses, sources and benefits are made available to stakeholders.

In view of this, a fixed price agreement was signed between DFID-sponsoerd Pro-Poor Opportunities in Service Markets (PrOpCom) and M & A's Greenery Ltd to provide professional service on Financial analysis of four de-stoning technologies available within Kano and Kaduna States of Nigeria.

Data for the study were obtained from stakeholders of the de-stoning technologies through the use of cost route technique. The data were analysed using partial budgeting technique and cash flow analysis. Result of the study revealed that the imported de-stoner used by KNAFES in Kura is the most capitalized, fastest, has the highest output per minute and the highest de-stoning efficiency rate of 87%. While the locally fabricated de-stoning technology used by DANDAGO is the least capitalized, slowest but has the same output per day and higher de-stoning efficiency rate than the de-stoner fabricated by HANIGHA (67%).

Gross Margin, net enterprise income, net profit, return to labour and return to capital were all positive for the four de-stoners indicating that all the four de-stoners are profitable. But KNAFES de-stoner has the highest gross margin, net profit, return to capital as well as return to labour thereby making it the most profitable amongst the four de-stoning technologies. Result from cash flow analysis indicates the net present value at 18 and 22 percent is positive for all the technologies. KNAFES has the highest NPV of (N1, 531, 148 and N1, 482, 339) at 18 and 22 percent, respectively. The internal rate of return is above 40% for all the technologies with KNAFES having the highest NPV of 42.70 %. This value is higher than the current interest rate of Nigerian Banks. The implication is that stakeholders can collect bank loans, invest in de-stoning ventures and pay back within the stipulated period without defaulting.

Break even quantity of de-stoned paddy for all the technologies is less than the number of bags of paddy that can be de-stoned in one year. KNAFES technology has the highest break even quantity of 5, 415 bags of paddy with N1, 082, 932 corresponding break even price which can be achieved in the first year of processing. DANDAGO technology has a break even quantity of 909 bags of paddy and N181, 859 as break even price. The pay back period for all the technologies is one year indicating the ability of stakeholders investing in de-stoning to pay off bank loan in the first year.

Market survey of de-stoned rice showed differences in rice prices of de-stoned rice from the four technologies with the price of rice left as a control recording the lowest price of N299.61

per *mudu*. Rice de-stoned with KNAFES technology has the highest price of N307.45. These differences indicate that even though rice traders do not pay premium price for de-stoned rice, however de-stoned rice can command premium price if only stakeholders are aware of the benefits. These prices were used to obtain the profitability of rice if traders are to include de-stoning activity as a component in rice processing. Positive gross margin was obtained across the technologies but the un de-toned rice has the highest gross margin of N392.20, but this resulted from the lesser variable cost of processing incurred but not as a result of increase in revenue. KNAFES has the highest gross margin of N349.00 while HANIGHA technology has the lowest gross margin of N304.40.

1.0 BACKGROUND

Rice is one of the most important staple crops in Nigeria, and local production of the commodity has increased several folds in the last 4 decades. Despite the increasing trend in local production, Nigeria is still a net importer of rice. In the local markets there is a greater consumer preference for imported rice compared to the locally produced commodity because of some quality issues associated with the local rice. Presence of stones in locally processed Nigerian rice has been identified as one of the major quality problems. The small Engleberg rice processing mill used by majority of rice processors in Nigeria, which includes a dehusking element and a polisher do not come with de-stoners. De-stoners are found only in a few high-tonnage integrated mills or are sold as separate equipment.

It was in the above context that the DFID-sponsored Promoting Pro-Poor Opportunities in Commodity and Service Markets (PrOpCom) engaged the services of M & A's Greenery Ltd to conduct a survey of improved drying and de-stoning techniques and technologies in Nigeria. Results of the survey revealed that there were very few de-stoners in use and most of them were imported with just a few being locally fabricated. Most of the identified de-stoners were expensive and come in different sizes and shapes while some few were integrated within sophisticated mills. The few locally fabricated de-stoners observed have not been perfected to de-stone rice properly. The study highlighted that because of their high costs, de-stoners are not available in large numbers like other processing equipment. They are mostly imported and are found only within the factories of a small number of equipment-manufacturing companies, few medium sized millers and government organizations. The locally made de-stoners are mostly prototypes and were observed within the premises of the companies. The study also pointed out that de-stoners have the potential to improve the quality of locally processed rice if information on its uses, sources and benefits are widely made available and if stakeholders could access finance to invest in the technology.

As a follow-up to the first study, PrOpCom contracted M & A's Greenery Ltd to carry out a second study to demonstrate the technical and financial viability of some of the main de-stoning equipment identified in the previous study. The major goal is to help stakeholders interested in investing in these technologies to assess and make decisions on technologies that are cost effective and will provide the returns within a period of time.

2.0 METHODOLOGY

2.1 Selection of De-stoners

Based on the previous study we conducted for PrOpCom as well as our knowledge of the current activities in the rice value chain, especially in the Kano axis, we selected 4 de-stoners for this study. Two of the de-stoners use imported machinery while the other 2 use locally fabricated equipment. Table 1 gives the names of the selected de-stoning ventures, their locations, type (make) of de-stoning machinery and the major features of the de-stoning process.

Table 1: Names and Locations of Identified De-stoners

S/N	De-stoner	Location	Type of Machinery	Remarks
1	Alh. Wada Shehu Dandago	Kano	Locally fabricated, manually operated	Low cost; could be suitable for small scale processor
2	Hanigha Nigeria Ltd	Kaduna	Locally fabricated with electric and diesel-powered prime movers	Locally fabricated; two types, one uses electric engine and the other uses diesel engine as prime movers.
3	KNAFES	Kura, Kano State	TQSC 56 Model (primary de-stoner) manufactured by Jianxing Qingong Machinery co. China; and QS 40 Model (secondary de-	The de-stoning process consists of 2 stages in which parboiled paddy is first de-stoned with the primary de-stoner (TQSC 56) followed by a second de-

			stoner) manufactured by Guangui Machinery Plant, Henna, China	stoning in the secondary de-stoner (QS 40).
4	TADCO Nigeria Ltd	Kano	QS 40 Model manufactured by Guangui Machinery Plant, Henna, China	The de-stoning process differs from that of KNAFES because it involves a single process using the QS40 model as sole de-stoner.

2.2 Study Team

The team of researchers engaged in the study included Agricultural Engineers and Agricultural Economists who participated in the previous survey on drying and de-stoning techniques and technologies. The use of the same team for this study is because the researchers already have knowledge and understanding of the technologies and the models available and how they compare.

2.3 Contact with Owners of De-stoners

Immediately after the contract for this study was formalized between M & A's Greenery Ltd and PrOpCom, our research team visited the selected de-stoners and made practical arrangement for the conduct of the exercise and agreed on timetable. It was decided that the study will start with the TADCO de-stoner, followed by Dandago and Hanigha, while KNAFES will be done last. This was because at the time of contact, KNAFES was in the process of installing their de-stoning machines.

2.4 Purchase and Processing of Paddy Rice



The purchased paddy being parboiled at TADCO

M & A's Greenery Ltd purchased 6 bags of "SIPI" rice variety for the de-stoning exercise. The paddy was parboiled and dried using TADCO technology. However, contrary to the usual TADCO parboiling process, the paddy was not sieved to remove stones or impurities. TADCO, Dandago and KNAFES de-stoners were each assigned one bag of rice for the exercise, while Hanigha was assigned two bags (one each for the electric- and diesel-driven prime movers). One bag was left un-destoned to serve as control for carrying out a comparative analysis by selling both the de-stoned rice and the control (not de-stoned) side by side. Because of differences observed in the weights of raw paddy and parboiled paddy, all the weights per bag were standardized to a 70 kg weight. This was necessary because all



The parboiled paddy being dried and shared evenly into bags

prices of inputs and outputs as well as fees charged for the de-stoning operation were based on per bag basis.

2.5 Technical and Financial Analyses

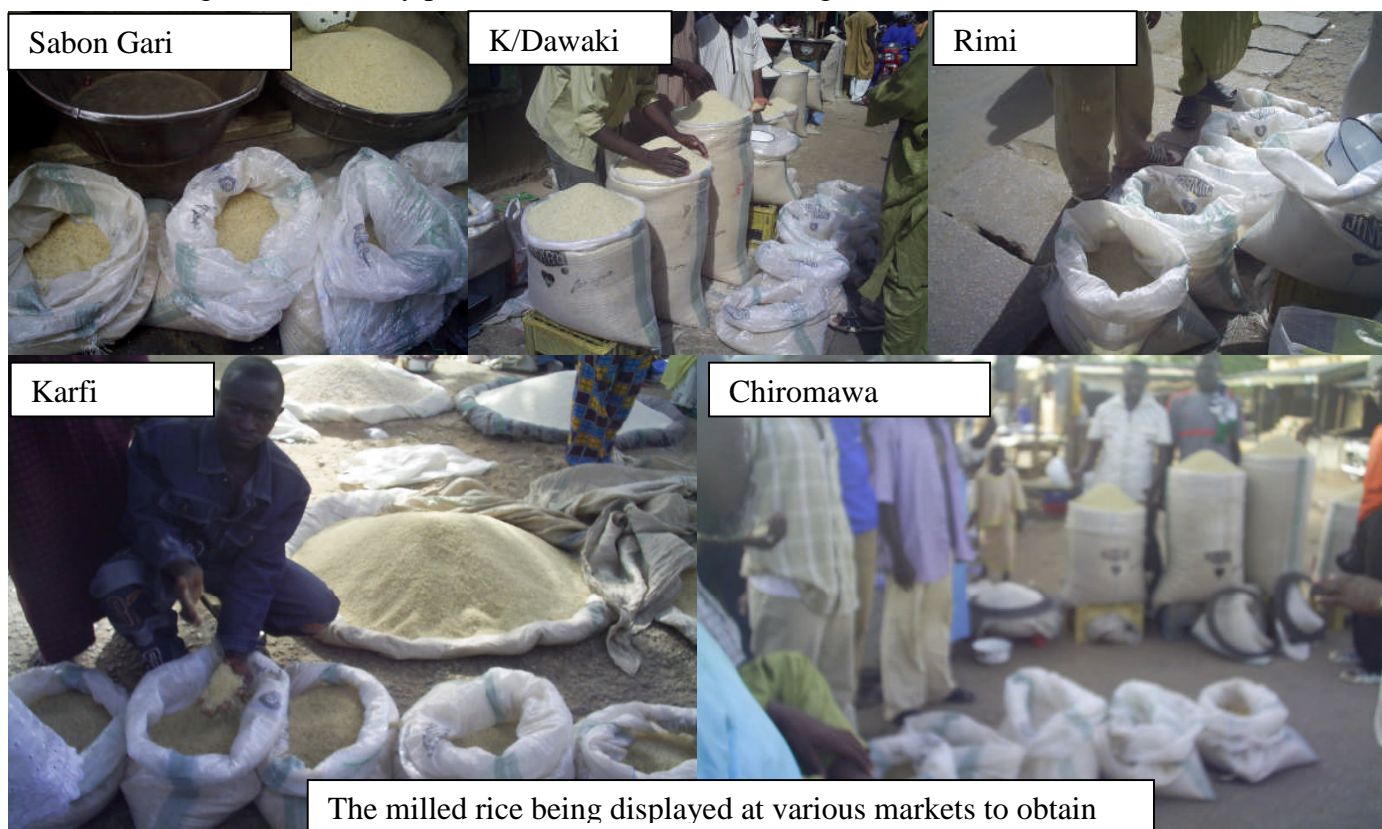
Price and technical coefficients as well as fixed costs were collected through the use of in-depth interview with the stakeholders. Input-output variables were measured in both physical and value terms. For the purpose of technical and financial analyses, two scenarios were considered. The first is the real situation while the second was assumed. The real analysis involved the use of the variables collected through cost route approach to find the profitability of the four de-stoning technologies and also to identify the most profitable technology in the first three years of investment. This involved the use of cash flow in order to make projections into the future. Even though none of these technologies is fully in commercial operation, the projections were made based on the input-output variables collected from the stakeholders. Discount factor of 18 and 22 percents were used in making future projections in order to calculate the Net Present Values and Internal Rate of Return for the four technologies.

The second scenario analyzed involved finding out the profit level that could be obtained by rice traders if they were to include de-stoning as part of rice processing activity just as is practiced with parboiling and milling. This was achieved by using the various rice prices obtained through market survey in the study area as well as the fee charged for parboiling, milling and de-stoning.

After de-stoning using the 4 de-stoning technologies, all the de-stoned paddy as well as the control were milled using the same milling machine. Market survey was conducted in six different markets to determine the market prices for the de-stoned rice. Three prices were taken from each market from which the average price was obtained. The buying/selling price was determined based on quality criteria used by the traders. The markets were Dawanau, Rimi, Sabon Gari, Karfi, Kwanar Dawaki and Chiromawa. The prices were collected per *mudu* and later converted on per bag basis. The standard measure for marketing rice in Kano is the *mudu* or *tiya*, a metal bowl that measures approximately 2.5 kg of milled rice. Forty (40) *mudus* are equivalent to 1 bag (100 kg) of milled rice.

The important measures of technical efficiency that were considered in this study included:

- Weight of the locally parboiled rice before de-stoning.



- Weight of the locally parboiled rice after de-stoning.
- Weight of stones removed per unit weight of de-stoned rice.
- Weight of broken rice per unit weight of de-stoned rice.

In order to demonstrate the financial viability of the selected improved de-stoning technologies, the following tools for measuring financial efficiency were employed:

- Gross Margin= Total Revenue – Total Variable Cost
- Profit or Net Margin= Total Cost – Total Revenue
- Benefit Cost Ratio= Total Revenue/Total Cost
- Returns on Capital= Profit/Total Cost x 100
- Return to Labour= Profit/Total labour Cost x 100
- Break even Point= $\frac{\text{Total fixed Cost}}{\text{Unit Price}-\text{Variable Cost/unit output}}$
- Pay Back Period= $\frac{\text{Total Investment}}{\text{Unit Price}-\text{Variable Cost/unit output}}$

Net Cash Flow/year

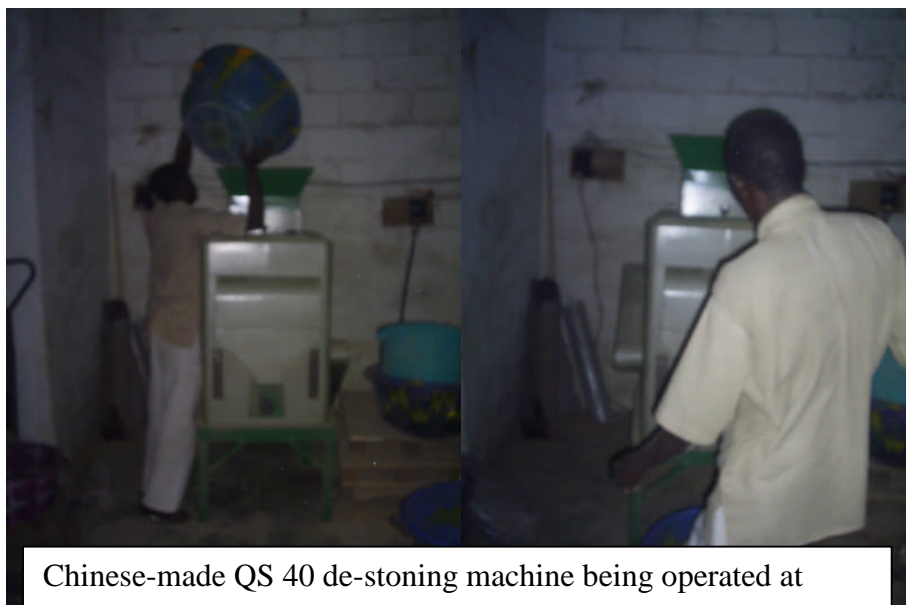
- Net Present Value (NPV)= Expected Benefits or cash flows – Expected costs discounted by the cost of capital
- Internal Rate of Return = The discount rate that equates the present value of cash inflows with the present value of cash outflows i.e. the rate at which NPV is equal to zero.

3.0 RESULTS

3.1 De-stoning Operations

3.1.1 De-stoning at TADCO

The TADCO de-stoning machine is QS 40 Model manufactured by Guangui Machinery Plant, Henna, China. It is electrically powered by a motor and is operated by one operator and a mate who helps the operator in feeding and bagging. The machine is provided with a feed



rate regulator which allows for variable feed rates for the de-stoner. At a constant feed rate of 5kg/min, the destoner gave an output of 1 bag (70kg) in 15min. This translates to an output of 280kg/hr. With this output, it means that 4 bags of paddy could be de-stoned in one hour. Hence for an eight hours working day, 32 bags could be de-

stoned. However, taking downtime (30 mins) into consideration, the machine could conveniently de-stone 30 bags of paddy per day. The weight of stones separated after de-stoning 70kg of the sample rice was 225g. The destoner has 2 outlets; lighter materials pass through one outlet and the heavier stones through the other. The two were added to give this value. No machine losses were observed in the stone outlet.

The electric power rating of the de-stoner is 1.1 kwh. The time taken to destone a bag was 15min. Therefore, the electric power consumed per bag is $1.1 \times 15/60 = 0.275$ kwh. The current Power Holding Company of Nigeria (PHCN) tariff is ₦ 8/kwh; this means the energy cost for destoning 1 bag is ₦ 2.20.

On maintenance and spare parts, the sieve is the part being replaced usually after a period of two (2) years. It has a unit cost of ₦ 2,000.00. The life span of the machine is estimated to be 10 years.

3.1.2 De-stoning at Dandago

The De-stoner at Dandago Agricultural Machinery Co. Ltd is a locally fabricated, manually operated machine. The De-stoner is operated by two people, an operator who operates the reciprocating handle and a mate who helps in the feeding and bagging. The machine also has



Locally fabricated manual de-stoner being operated at Dandago Agro-machinery



a manual mechanical linkage that serves as a regulator to the feed rate (similar to that of TADCO De-stoner). At a constant feed rate of 2.5kg/min, the machine was found to de-stone a bag of 70kg paddy in 35 minutes. This gives an output of about 120kg/hr. However, it was noted that the operator and the mate had to be exchanging positions (i.e. one person could not continuously operate the reciprocating handle for more than 10 minutes).

With the above output, it implies that for an 8 hours working day, the manual de-stoner could de-stone 960kg or approximately 14 bags of paddy. However, with the issue of exchanging positions during operation and other downtime, the machine could be reasonably estimated to have a capacity to de-stone 13 bags per day.

The weight of stones separated after de-stoning 70kg of the paddy was 256g. Some losses were observed at the de-stoner outlet. In technical terms, any rice coming out through the stone outlet instead of passing through the rice outlet is considered as machine loss. For this de-stoner, 1657grams of rice was collected as loss. Hence de-stoner loss out of the 70kg bag is:

$$1657/70,000 \times 100\% = 2.37\%$$

On maintenance and spare parts, the rivets bolts and nuts are the parts being replaced. The estimated cost per year for replacement of parts was ₦1000.00. The life span of the machine is estimated at 5 years.

3.1.3 De-stoning at Hanigha

The de-stoning machine at Hanigha Nigeria Ltd was locally fabricated based on Chinese design and uses an electric motor. It is operated by 2 people; an operator and a mate who assists in bagging. The machine has a feed rate regulator similar to that of TADCO. At a feed rate of 3 kg/min the machine was found de-stone a bag of paddy (70 kg) in 35 minutes. This means it has an output of 120 kg/hr. In an 8 hr working day it could, therefore, de-stone about 14 bags. Thus, the estimated capacity taking into account downtime losses equals 13 bags per day. The weight of



Hanigha de-stoning machine in operation (the green & yellow buckets collect de-stoned paddy & stones,

stones separated after de-stoning 70kg of the paddy was 28.9g. Hence, the stone separation efficiency of the machine is 29%. The company explained that the very low value of this efficiency is due to the fact that they have not fully finished proper adjustments on the machine. However, the scatter (machine) losses observed around the de-stoner were negligible (0.017%).

The replaceable spare parts on the machine were the belts and the bearings. With proper greasing, the bearings could take up to 2 years without replacement. The total annual maintenance cost may not exceed N 1,000.00. The energy, consumption of the 2hp electric motor was estimated at 0.75kwh. Since the time taken to de-stone one bag was 35minutes, the power consumed per bag was therefore $0.75 \times 35/60 = 0.4375\text{kwh}$. With PHCN tariff of N 8/kwh, energy cost was $(N 8 \times 0.4375\text{kwh}) = N 3.50$ per bag.

For the machine to be operated on diesel, an engine frame base needed to be constructed. The company could not make the construction within the time frame of this study. The de-stoning analysis at Hanigha was therefore not done with diesel-powered prime mover.

3.1.4 De-stoning at KNAFES

The de-stoning equipment at KNAFES was part of an integrated mill comprising of conveyors, de-stoners (primary and secondary) and a mill. The operation was designed as a continuous flow operation. For the purpose of our tests, the de-stoned paddy had to be intercepted and collected at the secondary de-stoner outlet.



Integrated rice mill at KNAFES, Kura (note the Chinese-made primary de-stoner at rear and secondary de-stoner in front)

The integrated mill uses electric motors to drive all the components. Therefore the company could use electricity from PHCN or in its absence, from diesel-powered generating set. At a feed rate of 6 kg/min, the machine de-stoned a bag (70kg) in 12 minutes. This gives an output of 350 kg/hr, which is equivalent to 40 bags for an 8 hour working day. Considering possible downtime, it can reasonably be estimated that the de-stoner could conveniently handle 37 bags of paddy a day.

The weight of stones separated after destoning one bag of paddy was 324g comprising of 280g from the primary de-stoner and 44g from the secondary de-stoner. The machine losses at the primary and secondary de-stoner outlets were negligible (0.16%). However, rice losses of up to 0.74 % and 0.06 were observed along the conveyors that carried rice to the primary and secondary de-stoners, respectively.

The total annual maintenance cost was estimated at ₦5,000, mainly for the replacement of belts and screens.

3.2 Stone Separation Efficiency

In addition to other technical and financial measures of efficiency observed during the de-stoning process at the two companies, the stone separation efficiencies of the de-stoners were assessed using the method of Ogunlowo and Adesuyi (1999) as follows:

Five thousand (5000) grams sample out of the de-stoned rice was collected, thoroughly cleaned manually and checked again to remove any remaining stone/debris (i.e. it is 100% free from stones). One hundred (100) grams of stone/debris (i. e 2% of 5000 grams) was deliberately introduced into the clean rice. The mixture was then fed into the de-stoner at a feed rate of 1500g/min. The weight of stone/debris (M_s) at the stone outlet was collected. The stone separation efficiency (η_s) is given by

$$\eta_s = M_s / 100 \times 100 \%$$

The experiment was repeated 3 times and average values were taken.

The results showed that TADCO de-stoner removed 78g out of the 100g of stones deliberately introduced; this means it has a de-stoning efficiency of 78%. The Dandago de-stoner removed 67g out of the 100g introduced, thus having a de-stoning efficiency of 67%. The highest de-stoning efficiency (87) was obtained with the KNAFES de-stoners while Hanigha had the lowest efficiency (29%). Table 2 shows a summary of the technical data collected.

Table 2: Summary of Technical Data

Variable	TADCO	Dandago	Hanigha	KNAFES
Make/Model	QS40, Chinese-made	Locally fabricated	Locally fabricated	Chinese-made: Primary de-stoner - TQ 50; Secondary De-stoner - QS 40
Output (kg/hr)	280@feed rate of 5 kg/min	120@feed rate of 2.5 kg/min	120@feed rate of 3 kg/min	350 @ feed rate of 6 kg/min
De-stoning time/bag	15 minutes	35 minutes	35 minutes	12 minutes
Output per day (bags)	30	13	13	37
Stone Separation Efficiency, η (%)	78	67	29	87
Machine Losses (%)	0	2.37	0.116	0.17
Power Source	Electrical	Manual	Electrical	Electrical
Energy Consumption/bag (kwh)	0.275	-	0.4375	0.933

Lifespan (years)	10	5	10	12
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3.3 Comparative Analysis of Investment Cost of De-stoning Technologies

The magnitude of Total fixed cost or investment costs provide useful guide to prospective investors about the level of investment needed to start a rice de-stoning business. Table 3 gives the various investment costs needed for the four technologies.

Table 3: Investment Costs for the Four De-stoning Technologies

Equipment/ Technology	TADCO	DANDAGO	KNAFES	HANIGHA
De-stoner (N)	350,000	100,000	750,000	250,000
Shade for De-stoner (N)	15,000	10,000	30,000	20,000
Installation (N)	30,000	10,000	200,000	30,000
Total	395,000	120,000	980,000	300,000

The technology with the highest capital requirement among the 4 technologies tested was the de-stoner used by KNAFES which has an investment cost of N980, 000. The fabricated de-stoner by DANDAGO has the least capital outlay of N120, 000. HANIGHA de-stoner needs an initial investment of N300, 000 while TADCO technology has a start up investment of N395, 000.

3.4 Comparative Analysis of Variable Cost Coefficients of the Four De-stoning

Technologies

Table 4 presents the variable cost coefficients for the four de-stoning technologies. A uniform source of power from PHCN was used to get the energy cost for the three technologies that can be electrically operated. However, if these de-stoners are to be operated using diesel, the energy cost per bag will increase. The total variable cost per bag for the four de-stoners varies from N38 for KNAFES to N75.33 for DANDAGO. The fee to be charged for de-stoning paddy across the four technologies is the same. The sum of two hundred naira (N200) is charged for every bag of paddy de-stoned irrespective of the efficiency of the de-stoner. The return per bag obtained is positive for all the technologies. However, the values ranged from N124 for DANDAGO to N162 for KNAFES.

Table 4: Cost and Return Coefficients for the Four De-stoning Technologies

Coefficients	TADCO	DANDAGO	KNAFES	HANIGHA
Cost of energy/bag (N)	22	-	7.50	3.50
Cost of labour/bag (N)	23	70	23	50
Land rent/bag (N)	2	5	7	4
Cost of spare parts and maintenance/bag (N)	0.22	0.33	0.5	0.23
Total variable cost/bag(N)	47.44	75.33	38	57.73
Fee charged for de-stoning/bag (N)	200	200	200	200
Return/bag (N)	152.56	124.67	162	142.27

3.5 Comparative Analysis of Financial Efficiencies of the Four De-stoning Technologies

Table 5 summarizes the financial viability of the four technologies in the first year of processing business. The table indicates that rice de-stoning can be an important and profitable economic activity in the study area. For the purpose of financial viability, it was assumed that all the technologies will be involved in contract de-stoning just like is obtained in parboiling and milling where N200 is charged for every bag of paddy de-stoned. Each of

these technologies is also assumed to work for a minimum of 288 days in a year. Based on that assumption, the table below presents the viability of the four de-stoners. Gross margin represents the contribution coming from each technology and is a good measure of profitability.

Table 5: Comparative Financial Analysis of the Four De-stoning Technologies in Naira

Indicators/Technology	TADCO	DANDAGO	KNAFES	HANIGHA
Revenue	1,728,000	740,736	2,160,000	740,736
Investment cost	395,000	120,000	980,000	300,000
Total variable cost	415,356	251,965	205,265	190,133
Depreciation	59,250	24,000	147,000	45,000
Total cost	474,606	275,965	352,269	235,133
Gross margin	1,312,644	488,771	1,954,731	550,603
Net profit	1,253,394	464,771	1,807,731	505,603

The technology used by KNAFES has the highest gross margin of NI, 954,731 while DANDAGO de-stoner has the least gross margin of N488, 771 (Table 5). The same technology with the highest gross margin depicts its profitability as confirmed by its net profit of N1, 807, 731. DANDAGO technology has the least net profit of N464, 771. But all the four technologies are profitable.

3.6 Comparative Financial Viability of the Four De-stoning Technologies

The result obtained from the gross margin and net profit of the four technologies gave a valuable insight for more analysis in order to access the performance of the four technologies, which will further prove the profitability of the de-stoning technologies. Table 6 presents performance indicators of the four technologies. The results clearly show that all the performance indicators for the de-stoning technologies were positive. Benefit-cost ratio indicates the proportion of revenue that goes into the payment of total expenses emanating from the de-stoning activity across the technologies. The highest benefit-cost ratio at both 18 and 22 percent discount factor is achieved by KNAFES. The technology by DANDAGO has the lowest benefit-cost ratio among the four technologies, but it still has a very positive ratio of 3.6

Return to capital, which is the rate of return on capital invested and compensation to the technology owner's resource involvement, is also positive for all the four technologies. This index is highest for KNAFES (513%). This implies that for every Naira invested in the technology, profit will be generated. DANDAGO Technology has the least but positive return to capital (168%). Similarly, labour input is more efficiently utilized in the technology used by KNAFES having recorded the highest return to labour (3342%). This could be depicted from the fact that all the technologies pay a flat rate per man-day irrespective of the number of bags that can be de-stoned by each technology. However, return to labour is still positive across the technologies.

Table 6: Financial Viability of the Four De-stoning Technologies

Coefficients	TADCO	DANDAGO	KNAFES	HANIGHA
Benefit-cost ratio @ 18% DF	4.98	3.65	9.13	4.40
Benefit-cost ratio @ 22% DF	4.90	3.60	8.97	4.33
Return to capital (%)	264	168	513	215
Return to labour (%)	659	380	3,342	592
Break even quantity (bags)	2,600	909	5,415	2,406
Breakeven price (N)	519,976	181,859	1,082,932	481,271
Payback Period (years)	1	1	1	1

Net present value @ 18% DF	1,061,625	393,661	1,531,148	428,246
Net present value @ 22% DF	1,027,783	381,112	1,482,339	414,594
Internal rate of return	42.49	42.25	42.70	42.38
Operating ratio	0.24	0.34	0.10	0.26
Fixed ratio	0.03	0.03	0.07	0.06
Gross ratio	0.27	0.37	0.17	0.32

Break even quantity indicates number of bags to de-stone for the anticipated revenue to cover initial capital outlay associated with the technologies. It identifies the level of output where all fixed and variable costs are covered and profit is zero. Break even analysis answers the question of how low can output fall before an investment actually begins to lose money. All the technologies would break even within the first year of investment. This is because the break even quantities for all the technologies are less than the total number of bags assumed to be de-stoned by each technology per annum. This indicates that profit can be generated from de-stoning business within a year of investment. The corresponding breakeven price for the technologies is N519, 976 for TADCO, N181, 859 for DANDAGO, N1, 082,932 for KNAFES and N481, 271 for HANIGHA technology.

Net Present Value (NPV), which is the difference between discounted cost and the discounted benefits, takes care of the differential time value of money. If NPV is positive, the investment returns more than the opportunity cost of capital or other interest rate used. The higher the NPV, the more viable the technology becomes. The net present value for all the technologies is very high for all the technologies at both 18 and 22 percent discount factor. KNAFES technology has the highest NPV(N1, 531, 148 and N1, 482, 339) while DANDAGO technology has the least NPV (N393, 661 and N381, 112) at 18 and 22 percent respectively.

Internal Rate of Return measures the income generating ability of the investment in relation to opportunity cost of capital. It is the rate of return on investment that is directly comparable to the prevailing interest rate charged by banks within the economy. It has the advantage of providing a measure of return that can be compared to each individual rate of return or opportunity cost of capital. It is profitable to invest on business whose IRR is higher than the interest rate charged by banks. The Internal Rate of Return for all the technologies is positive and higher than any prevailing interest rate in Nigeria. This further confirms the profitability of rice de-stoning as a business. IRR is highest for KNAFES (42.70) and lowest for DANDAGO (42.25).

Other profitability assessment indices measured include the Operating Ratio, Fixed Ratio and Gross Ratio. These indices measure the ability of any business to survive as an economic entity. The operating ratio should be more than the fixed ratio once a business is existing until a certain stage where expansion can take place. Gross ratio is the summation of fixed and operating ratio. For all the technologies, the operating ratio is greater than the fixed ratio indicating a survival rate for all the technologies once they become fully operational.

3.7 Comparative Analysis of Rice Prices from the Four De-stoning Technologies

Result of the market survey revealed different prices for the five samples of rice including the control that was not de-stoned. It is interesting to note that rice marketers pay premium price based on certain rice qualities such as shape, color, and absence of black tips and white belly. Stones in rice are not seen physically but more noticeable during cooking or on the table. These traders could not therefore pay premium price for de-stoned rice but rather, the prices given were based on the earlier mentioned qualities. Table 7 presents the average price of rice collected from Dawanau, Rimi, Sabon Gari, Kwanar Dawaki, Karfi and Chiromawa Markets.

The average prices of rice from each of these markets were summed and the average price obtained for each of the technology including the control.

Table 7: Average Price of Rice from 6 Markets

Technology	Rice Price/ <i>Mudu</i> (₦)
TADCO	307.22
DANDAGO	306.95
KNAFES	307.45
HANIGHA	305.22
CONTROL	299.61

The price of rice de-stoned using KNAFES is the highest (N307.45). This is closely followed by the rice de-stoned using TADCO de-stoner (307.22). The rice de-stoned using DANDAGO technology commands an average price of N306.95 which is higher than the price of rice from HANIGHA (N305.22). However, the rice obtained from the paddy that was not de-stoned which served as a control has the lowest price of N299.61. This shows that even though the rice traders claimed that stone is not one of the factors considered in paying premium price for rice, result from the markets surveyed revealed variation in prices from the different technologies despite the fact that the same parboiling and milling technology was used for processing. The differences in price can therefore be attributed to de-stoning since the price of the control is the lowest. It can then be concluded that de-stoning can have an impact on rice quality and premium price can be paid for de-stoned rice. This is going to be driven by the consumer preference for stone free brands and eventually the trader will adjust the price as a reaction to the market demand. But for this to happen, the products need to be branded.

3.8 Comparative Analysis of Gross Margin from Rice sales from the Technologies

This is the assumed situation mentioned earlier where the rice prices obtained from market survey will be used to find the gross margin of de-stoned rice from the technologies. Gross margin was obtained using the price of paddy purchased for the study as well as the fee charged for the parboiling, de-stoning and milling operations for this particular study. Revenue generated was obtained by converting the price/*mudu* obtained from market survey into per bag basis. Table 7 presents a summary of gross margin for the four different technologies as well as the control. From the table, it is evident that if rice traders are to combine parboiling, milling and de-stoning activities using the prices obtained for this study, profit will still be recorded across the four technologies irrespective of the increased variable cost for de-stoning.

Table 8: Comparative Financial Analysis of the Four De-stoning Technologies in Naira

(N)	TADCO	DANDAGO	KNAFES	HANIGHA	CONTROL
Price/ <i>mudu</i>	307.22	306.95	307.45	305.22	299.61
Price/50kgbag	6,144.40	6,139.00	6,149.00	6,104.00	5,992.20
Revenue	6,144.40	6,139.00	6,149.00	6,104.00	5,992.20
Total Variable cost	5,800.00	5,800.00	5,800.00	5,800.00	5,600.00
Gross Margin	344.40	339.00	349.90	304.40	392.20

From the table above, revenue was obtained by using the prices of rice collected through market survey for all the technologies including the control. Even though the price of rice that was not de-stoned is the lowest, it still recorded the highest gross margin of N392 when compared with the others. But this can be attributed to the fact that it also has the least

variable cost of N5, 600 while the others have the same variable cost of N5, 800. This uniformity in variable cost is as a result of using the same variety of paddy which was parboiled and milled using the same technology hence same variable costs. All the de-stoning technologies also charge the same de-stoning fee. This difference between the gross margin for the de-stoned rice and the unde-stoned rice further affirms the fact that the rice traders do not pay premium price for de-stoned rice. However, if consumers can pay premium price for de-stoned rice, the gross margin for the de-stoned rice will definitely be higher. Rice de-stoned using KNAFES technology has the highest gross margin (N349) among all the technologies while the rice de-stoned using HANIGHA technology has the least gross margin of N304.40. The positive gross margin recorded by all the technologies indicates that despite the increased variable cost associated with de-stoning, rice traders can still make a profit. It is very important to stress at this point that the price of raw paddy (N5, 000) contributed to the high variable cost. This also confirms earlier studies on the price of raw paddy contributing a high proportion of the variable cost of rice processing. If the price of paddy decreases lower than what is obtained now, the variable cost incurred in rice processing will decrease. This will also reflect in an increase in the gross margin. Rice traders/processors are therefore strongly advised to always source for paddy at markets where it is cheap or buy paddy when prices are at their lowest. This will go a long way in increasing the profitability of rice business.

Conclusion and Recommendation

This study was undertaken to assess the technical and financial viability of four de-stoning technologies of rice. The study revealed that rice de-stoning can become a very important economic activity in rice value chain. Rice de-stoning can also improve the quality of Nigerian rice. Financial analysis revealed that de-stoning could be highly profitable therefore worth investing not only by rice processors but also other business men and women looking out for profitable business to invest in. De-stoning on its own just like parboiling and milling can also be practiced by processors. For those processors interested in branding their own rice, then rice de-stoning can be incorporated with other rice processing activities to get an integrated system. Result of the study also indicated all the technologies having high return to labour and return to capital and high benefit- cost ratio, net present value and internal rate of return were also positive for all the technologies.

Results obtained from market survey showed that rice prices for de-stoned rice are higher than rice price for unde-stoned rice. The study also indicated that if rice traders can include de-stoning as part of rice processing activities just as it is being practiced with parboiling and milling, a positive gross margin will be obtained. This further stresses the profitability of de-stoning as an integrated component of rice processing.

Some of the recommendations from the study are outlined below:

- There is a technological information gap existing in rice processing. There is therefore a strong need for making rice processors aware of de-stoning technologies such that all rice processors become aware.
- The awareness should also include reasons as to how rice de-stoning can make a difference in rice quality as well as paying a premium price for de-stoned rice. This will make rice processors adopt de-stoning technologies.
- DANDAGO de-stoner, though locally fabricated, has a stone separation efficiency of 67% and possesses a lot of potential as a de-stoner. It is therefore recommended to small scale processors as well as entrepreneurs willing to invest in rice processing.

However, there is the need for some adjustments in the technology before it is adopted by processors.

- There is still more room for improvement of the HANIGHA de-stoner before it is recommended for adoption. The efficiency of the technology needs to be improved.
- Functional rice processing groups can be encouraged to get loans from banks and invest in KNAFES technology since it is capital intensive.
- For individuals or groups with medium capital, they can also be encouraged to adopt the TADCO technology since it is more efficient than DANDAGO technology but with high initial capital investment.
- Rice processors whose de-stoners were used for the study especially KNAFES and TADCO should be encouraged in all possible ways to explore branding and packaging of their rice in an integrated system such that their rice can become a household name.

5.0 REFERENCE

Ogunlowo A.S and A.S Adesuyi (1999). A low cost Rice cleaning /de-stoning machine. *Agricultural Mechanization in Asia, Africa and Latin America, AMA* **30** (1): 22 – 23.