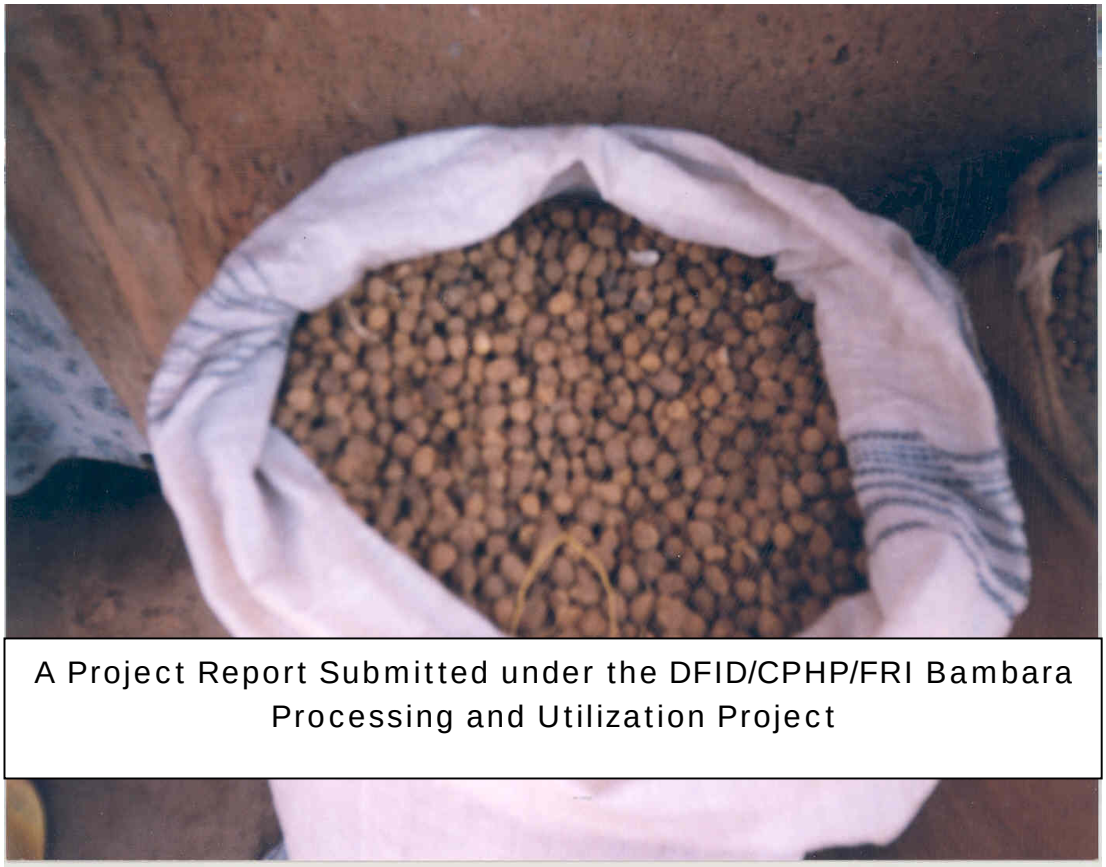
DISSEMINATION OF IMPROVED BAMBARA PROCESSING TECHNOLOGIES THROUGH A NEW COALITION ARRANGEMENT TO ENHANCE RURAL LIVELIHOODS IN NORTHERN GHANA
(ZB0332/R8261)

ADOPTION AND IMPACT STUDIES ON HIGH QUALITY BAMBARA FLOUR (HQBF) TECHNOLOGY TRANSFER IN NORTHERN GHANA



A Project Report Submitted under the DFID/CPHP/FRI Bambara Processing and Utilization Project

By

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ADOPTION AND IMPACT SURVEY OF HIGH QUALITY BAMBARA FLOUR (HQBF) TECHNOLOGY TRANSFER IN NORTHERN GHANA

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ABSTRACT

The Adoption and Impact study was undertaken as one of the activities under the DFID-funded high quality bambara flour (HQBF) technology transfer research project, which aims at the establishment of a value-added chain through HQBF-based recipe development, training of small-scale processors, and involvement of commercial processors as well as sale of well-packaged HQBF through identified market outlets. The study started with a broad overview of the performance indicators established in the baseline studies conducted initially and investigated the level of adoption of HQBF technology as well as its impact on the end-users. The specific objectives of the study were to establish the level of adoption of HQBF technology, examine the intensity of adoption, identify any modifications made by end-users, examine the determinant for effective adoption, track benefits/impact of the technology and identify constraints affecting HQBF technology adoption. A sample of 100 women, mainly processors, was selected from the project districts including Gushiegu-Karaga, Tolon-Kumbugu, Savelugu-Nanton and Tamale districts of the Northern region of Ghana using random sampling design for interview in June 2004. Statistical Package for Social Scientist (SPSS), Excel and Econometric Views were used for general data analysis. The Logit model was then used to investigate the determinants of adoption. The study findings established an effective utilization level of HQBF at 68%. Variables hypothesized to influence adoption of HQBF from the respondents' own assessments were time of awareness, consumer acceptability/quality of products, credit, availability of raw materials and weather conditions. However only the first two were statistically significant using the Logit model. Tentatively 28% of the respondents indicated 12.5% increase in demand for HQBF-based products. This translates into processing levels of up to 12.5 bowls (approx. 34 Kg) per processor per day as compared to 10 bowls before project inception. Sixty-one small-scale processors trained indicated earning more income. Extra income was in the range of ¢5,000 - ¢10,000 per week per processor using conservative figures, translating into monthly income of ¢104,000 - ¢320,000 per processor as compared to ¢84,000 - ¢280,000 per processor before inception of the project. Major constraints identified by respondents include difficulty in drying parboiled grains during the rainy season and unavailability of grains. In terms of impact on organizational uptake of knowledge, the project has been able to train 18 Agricultural Extension Agent trainers from the MoFA-WIAD and various NGOs in northern Ghana, who have acquired knowledge of HQBF production and utilization for use in their extension training activities. A total of 219 small-scale processors have also been trained on the household processing and utilization of high quality bambara flour, with demonstrations conducted in four districts for 370 participants, who now have access to the knowledge of HQBF technologies for household application. Two commercial HQBF production units are now in operation in northern Ghana, with 25 market outlets identified for the sale of their products. It was concluded that the rate of adoption of the technology is quite high, and the impact on income at this early stages of its introduction, is quite significant. There is the need however, for research to look further into the modifications effected by a few of the adopters.

INTRODUCTION

In 1999, a collaborative research project on the production, storage, processing, utilization and marketing of bambara groundnuts in Ghana was initiated by the Food Research Institute of Ghana with the Natural Resources Institute Limited in UK. The project which was sponsored by the Department for International Development's (DFID) Crop Post Harvest Research Programme (CPHP) with the Food Research Institute of Ghana as the lead Institution aimed at the development of effective promotion strategies which would improve food security of poor households through increased availability and improved quality of cereals and pulse foods and better access to food in the long term. The main objectives were to identify traditional processing methods of bambara in Ghana and to adapt these methods, or if necessary to develop alternative technology, so that the cooking process is improved; and to conduct studies to determine the market potential of bambara in Africa and elsewhere so that opportunities which could facilitate an increase in production are identified. Under the project an appropriate technique for the production of an acceptable, high quality bambara flour (HQBF) was developed. The HQBF is a shelf-stable high quality intermediate product for diversified food uses of bambara intended to help enhance the nutritional status of farm families, reduce hunger, and alleviate poverty through increased production of bambara.

After successful completion of the above project in 2001, the high quality bambara flour (HQBF) technology transfer research project was initiated in 2002. The high quality bambara flour (HQBF) technology transfer research project broadly aims at the establishment of a value added-chain through HQBF based recipe development, training of small-scale processors, and involvement of commercial processors as well as sale of well-packaged HQBF through identified market outlets. Under the training and community-based demonstration activity, ten (10) on site demonstrations have been conducted for well over 370 participants, mostly women and 219 small-scale women processors have also been trained on HQBF production since project inception in targeted districts including Gushiegu-Karaga, Tolon-Kumbugu, Savelugu-Nanton and Tamale districts of the Northern Region of Ghana. The present study investigates adoption and

impact of the HQBF technology transfer on targeted beneficiaries. The study starts with a broad overview of the performance indicators established in the baseline studies conducted initially and investigate the level of adoption of HQBF technology as well as its impact on the end-users. The specific objectives of the current study therefore are as follows:

- To establish the level of adoption of HQBF technology
- To examine the intensity of adoption
- To identify any modifications made by end-users
- To examine the determinant for effective adoption
- To track benefits/impact of the technology
- Identify constraints affecting HQBF technology adoption

METHODOLOGY

Sampling Procedure and Data Collection

Primary data was collected using a structured questionnaire. The structured questionnaire modules consisted of coded questions covering information on socio-economic profile, awareness of the HQBF technology, incidence/level of adoption, intensity/scale of adoption and modifications made. Impact of adoption, determinants for effective adoption and impediments to adoption of HQBF technology are other issues covered in the questionnaire (See Appendix 1). A sample of approximately 100 women, mainly processors, was selected from the project districts using random sampling design. The sample size was highly representative taking cognizance of the total number of processors trained in a particular area.

Survey Areas

The survey was conducted in selected project implementation areas where demonstrations and group training on HQBF technology had been previously conducted. As indicated in the technical training reports, the main project districts include Gushiegu-Karaga, Tolon-Kumbugu, Savelugu-Nanton and Tamale districts all in the Northern Region of Ghana. Table1 presents the various towns covered and the number of people interviewed during the survey.

Operational Definition of HQBF Adoption and Data Analysis

Numerous theories have been advanced by social scientists and other disciplines to explain and measure technology or innovation adoption (Feder *et al*., 1982; Rogers, 1995; Doss, 2003). Much of the literature on adoption of innovations/improved technologies concerns itself with the long-term rate of adoption, which is usually represented by an S-shaped cumulative frequency curve and the factors that influence the adoption decisions. Usually, a distinction is made between the degree of use (intensity of adoption) and incidence/level of adoption of an improved technology.

Table1. Towns visited and Number of People Interviewed.

District	Towns	Frequency	Valid Percent
Tamale	Tamale-Changri	5	5.2
-do-	Nyanshegu	11	11.2
-do-	Dohinayili	10	10.2
-do-	Kumbuyilli	3	3.1
Savelugu-Nanton	Molaa	3	3.1
-do-	Daire	6	6.2
-do-	Tampiong	6	6.2
Tolon-Kumbugu	Kumbugu	5	5.2
-do-	Nyankpala	4	4.1
-do-	Zangbalung	5	5.2
Gushiegu-Karaga	Karaga	8	8.2
-do-	Zinindo	5	5.2
-do-	Gushiegu	9	9.3
-do-	Gaa	5	5.2
-do-	Kpatinga	12	12.4
Total		**97**	**100.0**

For the purposes of this study, the intensity of adoption refers to the extent of use of a technology/innovation by the adoption unit once the decision to adopt has been made while the incidence/level of adoption refers to the situation where the adopting unit has used or not used the technology/innovation during a reference period. The former situation then becomes a continuous measure while the latter is a discrete state with binary variables (a processor is either an adopter or is not). With the above definition of adoption the most appropriate econometric model to use for the analysis is the logit regression model. The model is used to assess factors influencing the incidence and intensity of HQBF technology adoption.

The Logit Model

Following Pindyck and Rubinfeld (1981), the logit model is simplified as shown below:

$Ln\{P_i / 1\text{-}P_i\} = \beta_o + \beta_1 X_1 + \ldots\ldots\ldots \beta_7 X_7$

Where

P_i is a probability of being an HQBF adopter for the i^{th} respondent/processor, and ranges from 0 to 1(the qualitative variable adopt is 1 if the processor adopts the HQBF technology and 0 if does not adopt).

β_o is the intercept, β_i are the slope parameters in the model

X_i are explanatory/independent variables affecting adoption of HQBF technology

Soft ware packages

Statistical Package for Social Scientist (SPSS), Excel and Econometric Views were used for the data analysis. Data inputting was done in SPSS for descriptive analysis and cross tabulations. To examine factors affecting adoption of HQBF technology using the logit model, the SPSS inputs were exported to Econometric views for analysis. Excel was used to draw graphs for the presentation of results.

RESULTS AND DISSCUSSIONS

Socio-economic Background of Respondents

Bambara processing activity is exclusively carried out by women. With reference to the survey respondents, majority were middle age (average of 43 years old) married women with an average of 6 children and had no formal educational background. Bambara processing is the main source of income for the majority. Other primary income sources engaged in are farming, trading, sheabutter production and traditional birth attendance. Table 2 presents a summary of the socio-economic profile of the processors interviewed

Personal characteristics of respondents like age, educational attainment, and position in the household were hypothesized to influence the decision to adopt HQBF technology or do otherwise. Age is expected to influence adoption negatively. The younger respondents are more likely to receive innovations or new ideas since they have longer time horizon to enjoy benefits associated with the new technology. Family size, on the other hand, is expected to impact positively on adoption decisions, especially if labour requirement associated with the improved technology is relatively high. Larger family size would indicate more labour that could possibly be available for use. Likewise educational attainment is expected to influence adoption positively. Higher levels of education could be associated with high level of appreciation of innovative ideas. Respondents with supplementary income sources would have high-risk index, which allows more room for trying new things than those without supplementary sources of income.

Unfortunately with the exception of age, number of children (which is used as a proxy for family size) and income generating activity, there was not much variation in the socio economic characteristics of respondents as indicated in Table 2. It was therefore obvious that educational attainment, position in household and marital status would have insignificant influence on decision to adopt HQBF technology hence their elimination from the logit model.

Table2. Socio-economic Profile of Respondents

Socio-economic Characteristics	Districts Visited & % Response				
	Tamale	Savelugu	Tolon Kumbugu	Gushiegu Karaga	Overall
Age					
20-30	10.7	20.0	42.7	8.1	16.0
31-40	35.7	20.0	28.6	35.1	31.8
41-50	14.3	33.3	7.2	46.0	28.8
51-60	32.2	20.0	21.5	10.8	20.2
above 60	7.1	6.7	-	-	3.2
Total	100.0	100.0	100.0	100.0	100.0
Position in Household					
Wife	85.7	93.3	92.9	97.4	7.3
Head	14.3	6.7	7.1	2.6	92.7
Total	100.0	100.0	100.0	100.0	100.0
Marital Status					
Married	86.2	86.6	92.9	100.0	92.8
Widowed	13.8	6.7	7.1	-	6.2
Divorced	-	6.7	-	-	1.0
Total	100.0	100.0	100.0	100.0	100.0
Level of Education					
No Formal Education	89.7	100.0	100.0	100.0	96.9
Primary Level	10.3	-	-	-	3.1
Total	100.0	100.0	100.0	100.0	100.0
Main Occupation					
Bambara processing	65.5	66.6	92.9	61.5	68.0
Farming	-	26.7	-	23.1	13.4
Trading	27.6	-	7.1	-	9.3
Sheabutter processing	-	6.7	-	15.4	7.2
Traditional Birth Attendance	6.9	-	-	-	2.1
Total	100.0	100.0	100.0	100.0	100.0
Secondary Occupation					
Bambara Processing	3.5	-	-	2.5	2.1
Farming	-	13.3	-	38.5	17.5
Trading	31.0	-	57.2	23.1	26.8
Sheanut Processing	6.9	26.7	-	15.4	12.4
Rice processing	-	13.3	21.4	2.6	6.2
NA	58.6	46.7	21.4	17.9	35.1
Total	100.0	100.0	100.0	100.0	100.0
No. of Children					
1-5	41.2	46.7	71.4	35.9	44.4
6-10	58.8	53.3	28.6	59.0	53.6
Above 10	-	-	-	5.1	2.0
Total	100.0	100.0	100.0	100.0	100.0

Level of Utilisation

Level of utilization of HQBF technology as at the time of the survey, which was in June 2004, was very encouraging. Sixty eight percent (68%) of the sample interviewed was using the technology regularly as depicted in figure1. The study also revealed that only 28% of those utilizing the technology regularly did adopt for commercial purposes.

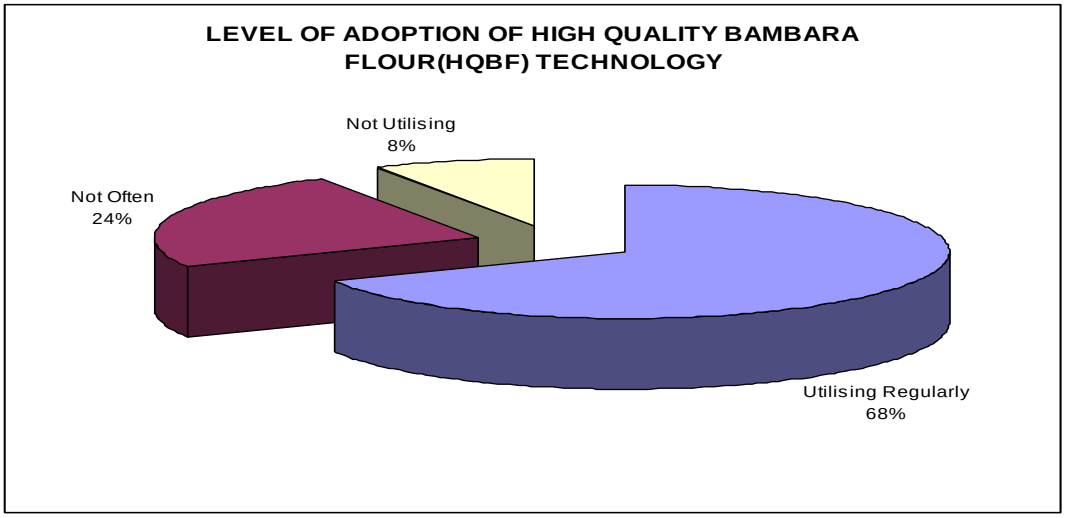

Figure 1. Level of Utilization of HQBF Technology

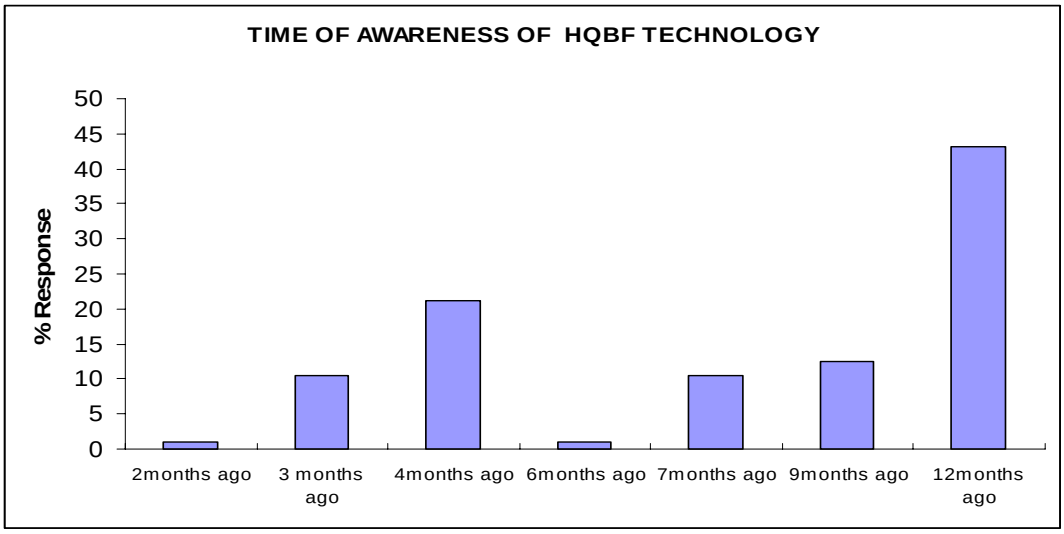

Figure 2. Time of awareness of HQBF technology

Among survey respondents, over 70 % were regular processors who purposely process bambara into Tubani, Koose and Gablee. Household based processors constituted less than 30% of the entire sample interviewed. The study revealed that household processors were more likely to adopt the HQBF on a more sustainable basis. Small-scale commercial processors were the least likely adopters because of the following reasons;

- Perceived effect of risk factors associated with technological changes
- Implications on profit margins
- Sunlight requirement for drying
- Extra labour requirement
- Non availability of grains (Availability of bambara is tied to its seasonal production)

However, the study observed that some small-scale commercial processors were using the HQBF technology at their households but for commercial purposes they resort to the old method. Disadoption is one important aspect which has not been given due consideration in past adoption studies. Information on why some processors discontinue using recommended technology gives thought provoking issues that are relevant for future roll out/dissemination programmes on the improved technology. Drawbacks of the technology are improved upon to increase the chance of acceptability and wider dissemination of the technology among the intended beneficiaries. For instance, seasonal production creates a barrier to processors adopting a new processing technology. Because these processors tend to use localized supplies of bambara as their main source of raw material input. Therefore for a small-scale processor to use HQBF technology continuously, raw material base should be readily available and easily accessible.

Scale/Intensity of Adoption

Intensity of adoption refers to the extent of use of a technology/innovation by the adoption unit once the decision to adopt has been made. In reference to the level of adoption of HQBF established under this study, 68% of the sample interviewed were using the technology regularly, 24% rarely used it while 8% never used the technology. Among the percentage using the technology (either often or not often), the study revealed

that 88% had not made any modifications to the HQBF technology and therefore had adopted a complete technological package; full scale adoption. Those who had made modifications to the improved technology constituted only 8% of the sample interviewed see figure 3.

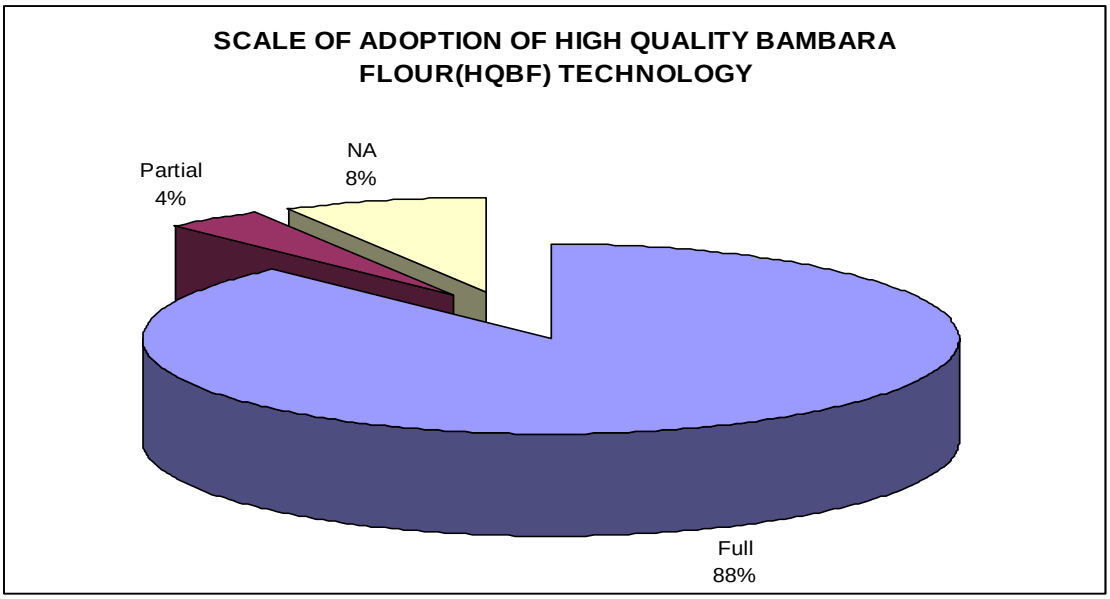

Figure3. Scale of Adoption of HQBF Technology

Modifications

Modifications made by some respondents are outlined below:

- Time of pre-heating is shortened to save on fuel cost
- Addition of yam/cassava flour to improve further on the texture of products; Tubani, Koose and Gablee
- No soaking to save time
- Crack before dehulling

Figure 4 presents HQBF and modified HQBF production. Unfortunately the current study did not probe into detail cost and benefit implications with respect to the modified HQBF.

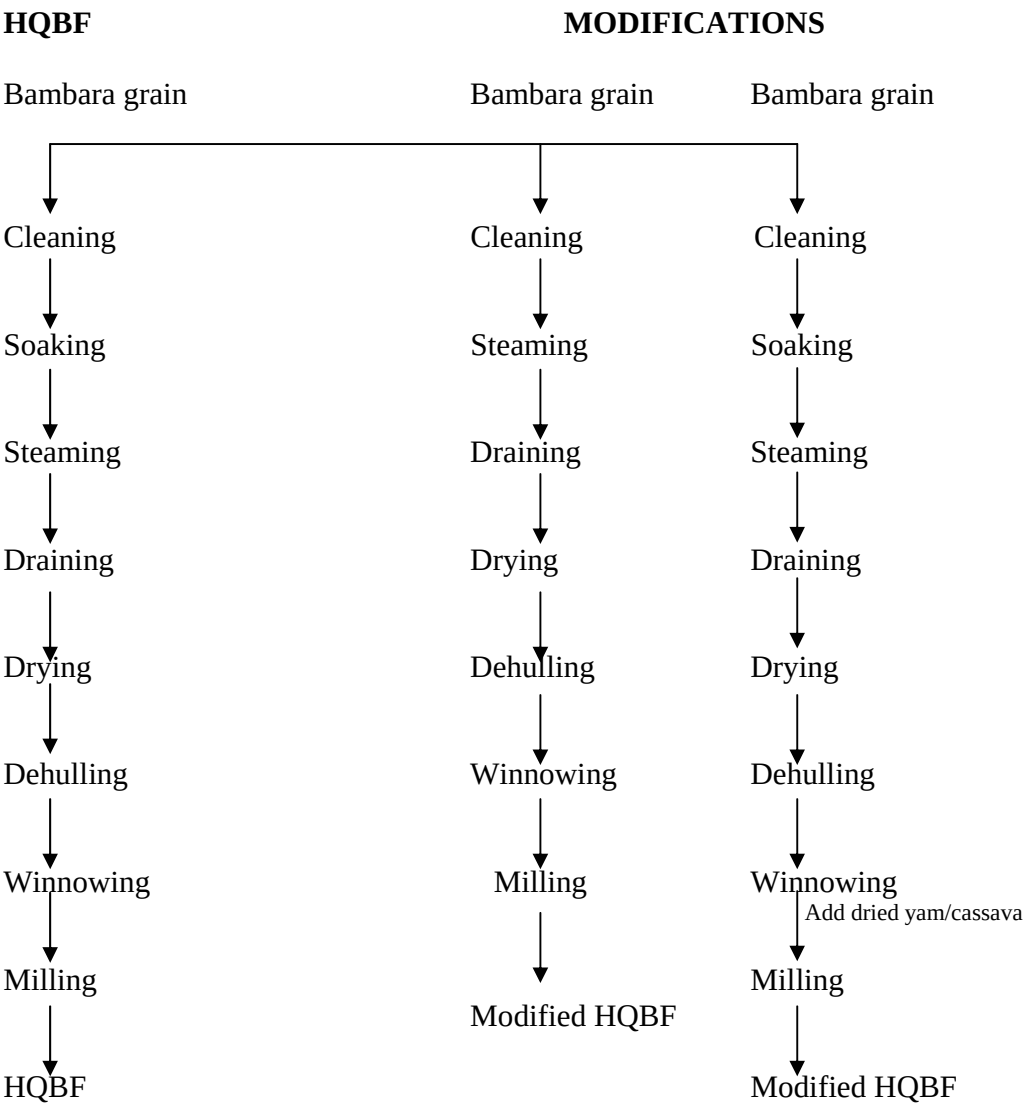

Figure 4. Flow chart for HQBF and modified HQBF production

Sources of information

This study has shown that among the most important agents for technological change in the agro-processing sub sector are the MOFA/WIAD extension agents. They have the capacity to handhold potential users and make the technology operate effectively. Using the trainer of trainers technique MoFA/WAID Extension Agents (AEAs) were trained by

the technology developers, the research partners, and they in turn trained others on production of HQBF in their respective operational areas. As indicated earlier, training programs were organized for processing groups; on-site demonstrations were conducted at the village level and one-on-one consultations among processors after training sessions continued. Figure 5 presents the various sources of information and knowledge about HQBF technology among respondents

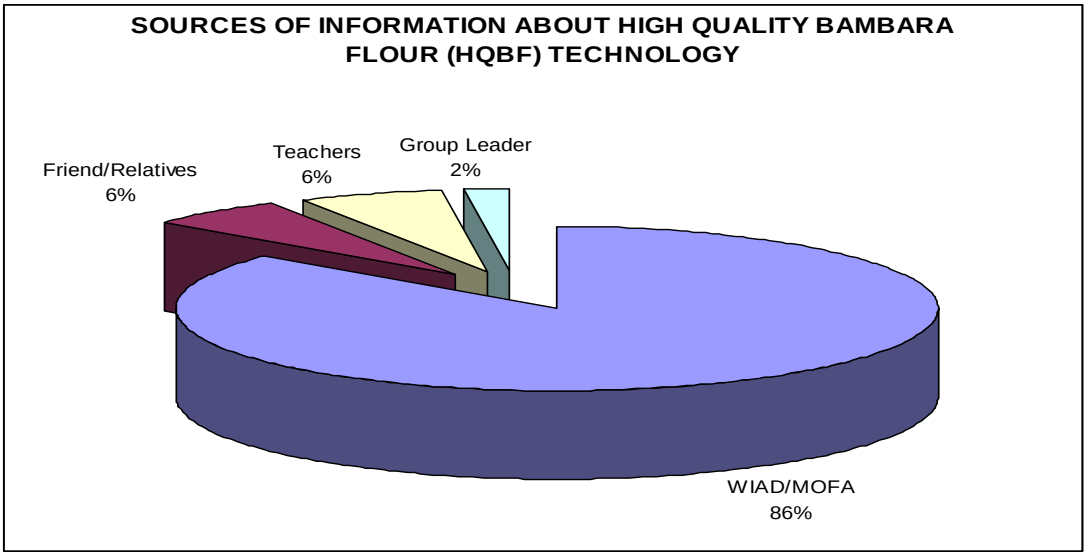

Figure 5. Sources of information and knowledge about HQBF Technology

Majority (86%) of respondents indicated WAID/MOFA as the primary source of information and knowledge about HQBF production while the rest acquired knowledge on HQBF from friends and relatives, teachers and group leaders in the communities. The role of friends and relatives in the technology transfer process is significant. It has positive implications on the usefulness of the improved technology and the capacity to spread further after training.

Determinants of Adoption of HQBF technology

A preliminary investigation on determinants of HQBF adoption was made by asking respondents to express their views on possible factors that affect ones decision to

accept/adopt or reject/not adopt an improved technology. Table 3 presents results on proposed factors affecting respondents' decisions on HQBF technology adoption.

Table3. Preliminary Investigation into determinants of HQBF Adoption

Factors	% Response		
	YES	NO	Remarks
Availability of market	55.1	44.9	Respondents had a mixed reaction to the question of whether availability of market was a determinant of HQBF technology adoption, with close to 45% expressing that for now the issue of market for processed products might not affect ones decision to adopt the technology while the rest think otherwise.
Cost of inputs	51.7	48.3	Similarly cost of inputs was considered to be an issue by a little over 50% of the respondents since HQBF production has an element of steaming with additional cost on fuel.
Availability of Sunshine	86.5	13.5	Availability of sunshine was a key decision factor of utilization of HQBF technology which requires sunlight for drying after the pre- heating treatment. This they had no control over.
Availability of Raw Materials	80.9	19.1	Availability of raw material (bambara grain) was another key decision factor of utilization of HQBF technology. Apparently respondent indicated non availability of credit to do bulk purchases of grains.
Credit	44.3	55.7	Less than 50% of respondents indicated that availability of credit would not affect their decision to adopt or not adopt the HQBF technology initially though it could influence sustainability issues.
Quality/Consumer Acceptability	55.2	44.8	Consumer acceptability of HQBF based products was crucial to more than 50% of the respondents interviewed and an important decision factor of technology adoption.
Time of Introduction of technology	80.9	19.1	Time of introduction was very important. It has to be tied to the peak period of bambara supply (This has also been found to be an important determinant of technology adoption elsewhere e.g. Kernga 2003)
External Influence	1.1	98.9	Respondents indicated that external influence e.g. from spouses, plays a minor role in the HQBF technology adoption process.

Again respondents were asked to rank factors affecting their decisions in order to settle on important factors to be included in the Logit model, which is the adopted econometric analytical tool for this study. As shown in Table 4, availability of sunshine, availability of raw material (bambara) and time of introduction of HQBF technology ranked first, second and third most important factors affecting adoption of HQBF technology respectively.

Table 4. Ranking of responses on factors affecting HQBF technology adoption

	Ranking (% Response)							
Factors	1st	2nd	3rd	4th	5th	6th	7th	8th
Availability of market	-	18.4	30.6	24.5	22.4	4.1	-	-
Cost of inputs	10.6	23.4	34.0	25.5	6.4	-	-	-
Availability of Sunshine	41.0	34.6	11.5	9.0	1.3	1.3	1.3	
Availability of Raw Materials	37.5	33.3	18.1	8.3	2.8	-	-	-
Credit	37.5	12.5	25.0	10.0	12.5	2.5	-	-
Quality/Consumer Acceptability	16.3	20.4	12.2	28.6	12.2	10.2	-	-
Time of Introduction of technology	16.7	33.3	16.7	16.7	-	16.7	-	
External Influence	-	-	-	-	-	-	-	100.0

Combining results summarized in Tables 3 and 4 (Responses derived from the formal survey), variables hypothesized to influence adoption of HQBF from the respondents own assessments are:

- Time of awareness
- Consumer Acceptability/Quality
- Credit

- Availability of Raw materials
- Availability of Sunshine

In addition to the factors enumerated above, some socioeconomic factors, which have been proposed to affect decisions on technology adoption (Doss 2003 and Gracia 2001) and also suspected from the socio economic profile of respondents, were introduced into the model to check the level of influence on adoption of HQBF technology. Table 5 presents result on variables hypothesized to influence adoption of HQBF technology.

Table5.Variables/Factors Influencing the Level & Intensity of adoption of HQBF Technology

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	2.187572	1.542694	1.418020	0.1603
Age	3.16E-05	0.027098	0.001166	0.9991
Period of Awareness (AWARE)	-0.236051	0.089858	-2.626940	0.0104
Number of Children (CHILD)	-0.065695	0.145895	-0.450288	0.6538
Consumer Acceptability (FACCEPT)	1.550971	0.569998	2.721012	0.0081
Credit (FCREDIT)	-0.073424	0.567533	-0.129374	0.8974
Availability of Raw Material (FRAW)	-0.658754	0.776188	-0.848704	0.3987
Availability of Sunshine (FSUN)	0.698511	0.870990	0.801973	0.4251
Main Source of Income (MAIN)	0.368610	0.704669	0.523097	0.6024
Log Likelihood	-43.00301			

As indicated in Table5, among the variables hypothesized to influence adoption of HQBF only the period of awareness and consumer acceptability turn out to be significant using the Logit model analysis.

Impact of adopted technology

As indicated elsewhere in the project-reporting requirement, key performance indicators to be considered in the impact tracking include the following;

- Number of people who have acquired knowledge of HQBF production and utilization
- Number of women processors trained,
- Number of processors using the HQBF technology
- Number of commercial HQBF units in operation
- Percentage increase in household income levels
- Number of market outlets identified

Overview of baseline performance indicators

Table 6 presents the baseline levels of the performance indicators, the expected levels and the achievements made so far. In addition to the key impact indicators outlined above, respondents were asked to express their views on changes in demand, yields, selling price, and taste and labour requirements. Responses on these indicators also formed the basis for calculating changes in some of the key impact indicators. Table 6 gives summary results of changes in demand, yields, selling price, taste and labour requirements of HQBF based- products.

- *Taste*- Improvement in product quality/taste is the most important benefit perceived to be associated with the adoption of HQBF technology and probably the key selling point. This confirms the assertion that technology use in the food-processing sub sector is closely connected with the desire to improve quality (Baldwin *et al*., 1999; Baldwin and Sabourin, 2002). Taste of all the three key products is greatly enhanced. This influence sales positively and result in more recommended sales. In situations where market size is fairly constant products sell faster and processors have more time for other commitments. Other improved qualities of HQBF based product enumerated by respondents include smooth and soft texture and better colour/enhanced

appearance. Products are also healthier without stones and other foreign particles. Heat treatment kills all the weevils and other pest.

- Demand- Estimated increase in demand as a result of adopting HQBF technology is 12.5%. It must be noted that the right procedure has to be followed critically for the expected benefits to be reaped.
- Yields - HQBF rises when well beaten and therefore turning out higher yields as compared to the traditional method.
- Others include improved storage periods; with the traditional processing method flour has to be used within 4 days but HQBF can store much longer- for about a month. No stomach cramps were observed after eating HQBF products. With the old method one has to add cassava flour to reduce the after mouth effects.
- Less oil used for frying Koose. Amount of oil used in frying HQBF products is reduced by a third as compared to the traditional method. With the old method 1.5 bowls of sheabutter oil fries 3 bowls. Currently using 1 bowl of sheabutter oil for the same amount of grains. However, some respondents indicated that this is offset by extra cost of fuel for heat treatment.

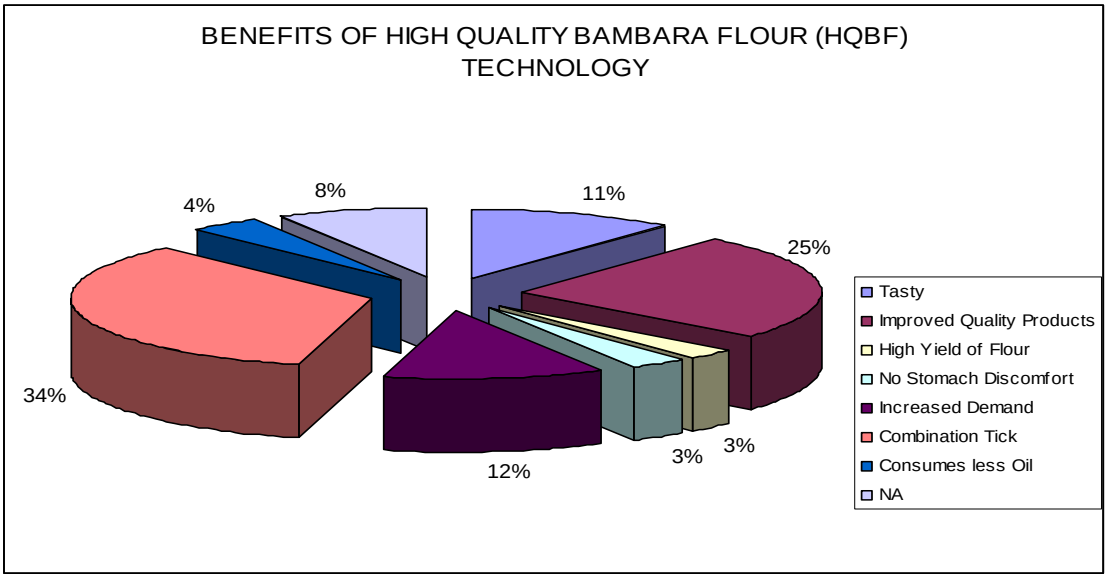

Figure 6. Percentage distribution of respondents according to most important benefits derived form HQBF technology.

Table 6 Base levels of performance Indicators and the Achievements

Indicator	Current level	Expected level	Achievement
Processing technology	Traditional	HQBF	
Socio-economic			
Processing levels	1-10bowls/processor/ day	Increase in processing level	Tentatively 28% of the respondents indicated 12.5% increase in demand for HQBF based products. This translates into processing levels of up to 12.5 bowls (approx. 34Kg)/processor/day.
Monthly Income levels	¢84- 280,000/processor	Earn additional income	Extra income was in the range of ¢5-¢10'000 /week/processor using conservative figures; translating into monthly income of ¢104-¢320'000/processor
Number of people earning extra income (use of HQBF)	0	No estimated target	28% of sample interviewed earn more income. Using the total number of 219 small scale processors trained by MOFA, estimated number of smallscale processors currently earning extra income is approx. 61. This excludes those who were trained by relative/friends and other people
Private sector involvement	0	Involvement of 2 commercial operators	A total number of 2 commercial processors involved.
Market outlets for HQBF	0	25 market outlets	25 market outlets identified
Number of Recipes	11	30	A total of 32 recipes bambara-based recipes have been developed/standardized
Training			
Number of Demos/workshops	0	-	Ten community-based demonstrations conducted for 370 participants
Number of people trained	0	200 processors,10 NGOs & cateress	219 small scale processors trained
Number of commercial HQBF units in operation	0	2	Two commercial HQBF production units in operation
Number of market outlets identified	0	20	25 market outlets identified

Table 7. Summary of respondents' views on some impact indicators

Impact Indicator	% Responding to Change			
	Decreased	Same	Increased	Remarks
Demand	-	6.5	81.5	The rest did not make any comment in respect of changes in demand. Although majority of the adopters were using at the household, the general impression was that due the marked improvement in taste of HQBF products household members enjoyed extra HQBF products. Those who used the technology for commercial purposes experienced 12.5% increased in size of demand.
Yield	3.2	8.6	77.4	10.8% did not comment. Change in yield of HQBF is relative depending largely on how well flour mixture is beaten
Selling Price	-	46.2	16.1	37.6% did not comment. Significantly the household users could not make any comment on selling price. Majority of the commercial users had to maintain the selling price but indirectly reduced the size per unit to effect marginal increase in the relative prices.
Taste	-	-	93.5	Only 6.5% of the sample could not comment on technological effect on taste. Improvement in taste of HQBF was very obvious with overwhelming proportion of the adopters indicating taste as a motivating factor in the adoption process.
Labour	3.2	60.2	17.2	19.4% did not make any comment. Relatively there were no significant differences in labour demands though the improved technology involved additional processing steps.
Expenditure	11.0	49.5	6.6	33% did not make any comment. Majority were of the view that savings in amount of oil used for frying koose were stripped off by cost incurred in fuel for pre-treament.
Income	3.3	11.0	45.1	40.7% did not make any comment.
Profit	3.3	7.6	48.9	40.2% did not make any comment. Extra profit made was in the range of c5-10'000/day

Improving the level of effectiveness of HQBF technology transfer

Views of processors/respondents were sought concerning best practices to improve on the effectiveness of HQBF technology process. Results are summarized below;

- Create more awareness & Intensity training
- Ensure Credit facility
- Monitoring
- Use of trainer of trainers' strategy
- Provision of milling machine
- Ensure availability of raw material
- Combination tick

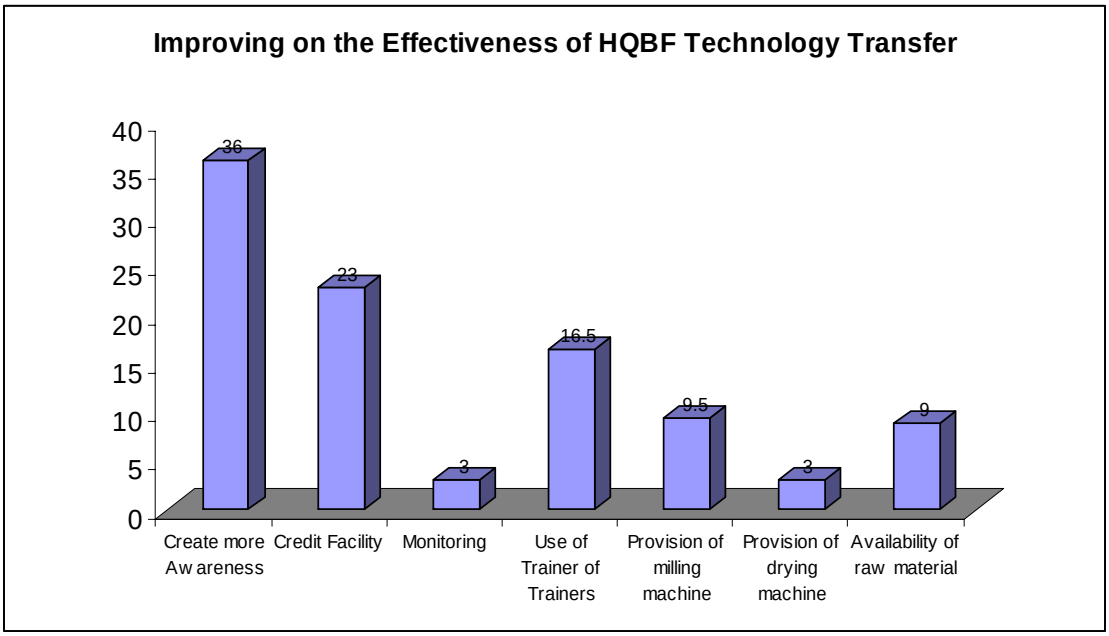

Fig 7. Respondents suggestions on how to improve on the effectiveness of HQBF technology transfer

Problems/Constraints

As common with most new technologies adoption process, some (54%) processors encountered teething problems with HQBF technology. Key (the most cited impediment to technology adoption) among these is the issue of difficulty in drying parboiled grains during the rainy season and non-availability of grains, which was raised by 33% of the sample interviewed. Other complains reported by the minority were time consuming nature of the new technology, unavailability of mills and high cost of fuel. Problems enumerated by respondents are graphically presented in figure 8. Apparently, a lot more people indicated that there was no problem though earlier discussions revealed quite a number complaining about difficulty in drying and unavailability of grains.

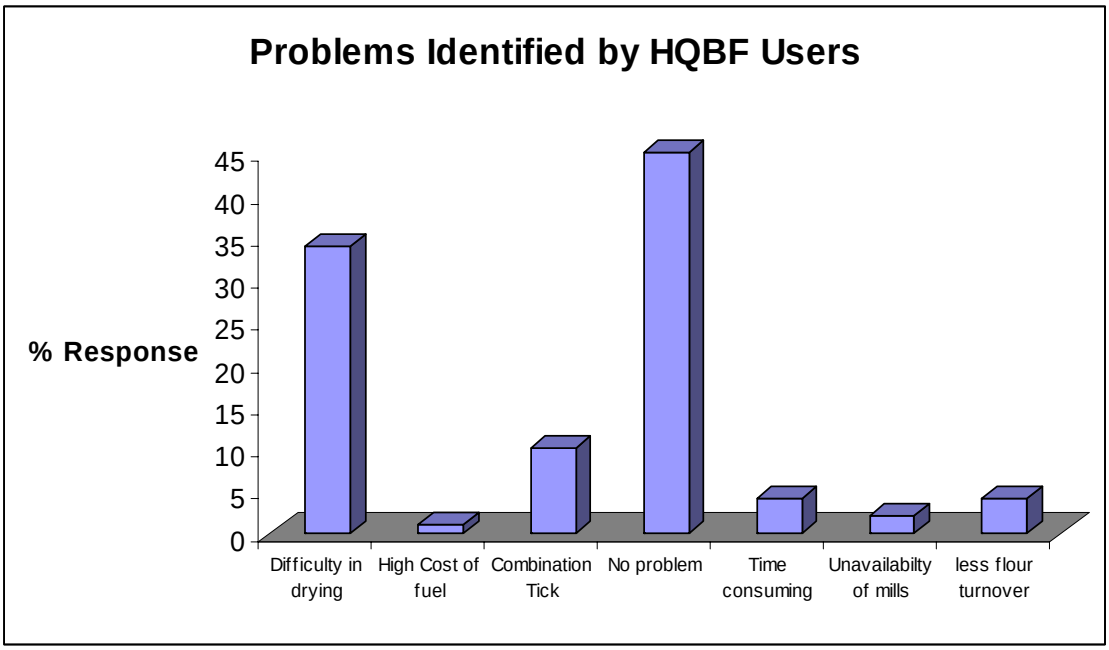

Fig. 8 Problems identified by respondents.

CONCLUSIONS AND RECOMMENDATIONS

Major findings of the study are outlined below:

- Effective utilization level of HQBF is estimated at 68%.
- Variables hypothesized to influence adoption of HQBF from the respondents own assessments include time of awareness, consumer acceptability/quality of products, credit, availability of raw materials and sunshine.
- Statistically time of awareness and consumer acceptability/quality of HQBF based-products significantly affect adoption decisions.
- Tentatively 28% of the respondents indicated 12.5% increase in demand for HQBF-based products. This translates into processing levels of up to 12.5 bowls (approx. 34 Kg)/processor/day as compared to 10 bowls before project inception.
- Extra income was in the range of ¢5 - ¢10’000/week/processor using conservative figures. Translating into monthly income, this comes to ¢104 - ¢320’000/processor as compared to ¢84 - ¢280’000/processor before inception of the project.
- Approximately 61 small-scale processors earn more income.
- Major constraints identified by respondents include difficulty in drying parboiled grains during the rainy season and unavailability of grains. To a lesser extent, relatively time-consuming nature of the new technology, unavailability of mills and high cost of fuel were mentioned.

Technology development should be approached as a partnership between local food processors (industry) and researchers to the greatest extend possible. This is the innovative coalition partnership approach that was adopted in the technology dissemination. Research that is focused on an identified problem of a particular group will be most readily received and adopted by the group who share ownership of the project. Other recommendations made in relation to effectiveness of HQBF technology transfer include the following:

- Create more awareness and intensify training
- Give credit facility
- Monitor or do more follow up visit to beneficiaries
- Use trainer of trainers strategy to reach out to more people

- Provide milling machine
- Work on production related issues to increase supply response to expected demand

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APPENDIX 1

QUESTIONNAIRE

Adoption and Impact Survey of High Quality Bambara Flour (HQBF) Technology Transfer in the Northern Region

A. Personal Data

Name of respondent…… Marital status……

District……... Educational Level……..

Town…….. Main Occupation……

Age & Sex……. Secondary Occupation……...

Position in household……. No. of Children……...

B. Scale of Adoption

1. When did you become aware of HQBF processing technology? …….…….

2. Where did you obtain the information?.....

3. When did you start using the technology?.....

4. Are you still using the technology?.....

5. If not why?
.....
.....
.....

6. If yes which aspect(s) of the technological package are you utilizing?
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.....
.....

7. Give reasons for not utilizing the others
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……
……

……
……

8. What are the benefits derived from using the technology?

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9. Did you have any problems with the use of the technology?

10. If yes, please describe the problems

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……
……

11. Describe modifications made if any and explain why?

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……
……

C. Impact of adopted technology

12. Please indicate any change in the following as a result of using the technology

Indicator	Decreased	Same	Increased	Description
• Demand for bambara based products (BBP) • Level of yields of BBP • Selling prices • Taste of BBP • Income levels from BBP • Expenditure • Profit • Labour demands for the preparation of BBF				

D. Determinants for effective adoption of High Quality Bambara Flour

13. In your opinion what are some of the factors affecting the effectiveness of adoption of HQBF (Rank in order of importance and give reasons if possible)

Factor	Response(Yes=1, No=2)	Rank (1=most important)	Reasons
• Availability of markets • Cost of inputs/Production cost • Availability of sunshine • Availability of raw materials (bambara) • Credit • Quality/Consumer acceptability • Time of introduction of the technology • External influence on decision making • Others (Specify)			

14. What do you think can be done to improve the level of effectiveness of technology adoption?

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