

Millers bank on bambara processing techniques

Validated RNRRS Output.

New processing technologies are helping to ensure that bambara will continue to contribute to income and nutrition for people in West Africa—especially poor farmers. High-quality bambara flour, one of the principal innovations, is now widely used. Marketing opportunities for the flour have been identified and problems in the marketing system resolved, and millers report that demand for bambara has increased by 12.5%. To help the process, new bambara flour-based recipes have been tested and validated with consumers. The technology is currently in use in Ghana, and a market study shows that there is high potential for its use elsewhere.

Project Ref: **CPH04:**

Topic: **5. Rural Development Boosters: Improved Marketing, Processing & Storage**

Lead Organisation: **Food Research Institute (FRI), Ghana**

Source: **Crop Post Harvest Programme**

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Description

CPH04

Research into Use

NR International
Park House
Bradbourne Lane
Aylesford
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Geographical regions included:

[Ghana](#),

Target Audiences for this content:

[Crop farmers](#), [Processors](#),

A. Description of the research output(s)**1. Working title of output or cluster of outputs.**

In addition, you are free to suggest a shorter more imaginative working title/acronym of 20 words or less.

Working Title: Development and dissemination of bambara processing technologies through a partnership approach to enhance rural livelihoods in Ghana

Shorter version: Bambara processing technologies for enhanced rural livelihoods

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.**Crop Post Harvest Programme****3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities. As with the question above, this is primarily to allow for the legacy of the RNRRS to be acknowledged during the RIUP activities.****R7581, R8261 and R2986****Institutional Partners and Individual Contact Persons Involved in the Project****1. Food Research Institute (FRI)**

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5. Min. of Food and Agric. (MoFA); WIAD

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6. Theresa Owusu Enterprise (Commercial Partner)

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4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? (**max. 400 words**). This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.

Bambara groundnut is an important source of income and nutrition for peoples in West Africa, especially the **rural poor farmers**. Production has been on the decline in recent years primarily because of **processing constraints**. The purpose of the project was to develop and promote **bambara processing and utilization technologies** for improved **food security** and **livelihood of poor households**.

Between 2000 and 2002, bambara processing technologies were developed under CPHP project R7581. One method, involving the use of low concentrations of a local natural rock salt, *Kawe*, ($\text{Na}_3\text{CO}_3\text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$) for pre-soaking and cooking, was established as an effective means of reducing the cooking times by half, of the most difficult-to-cook varieties of bambara. The second method was for the preparation of an acceptable **high quality bambara flour** (HQBF) for use in the preparation of various traditional foods and recipes. **Marketing opportunities** for bambara in Ghana, Africa and globally were also identified and the constraints to the marketing system established. Bambara production and utilization in Ghana was also established and the constraints limiting its increased utilization identified.

Subsequently, between 2003 and 2004, the HQBF technology was disseminated in northern Ghana through an innovative coalition approach, under CPHP project R8261. The technology was transferred to two commercial

entrepreneurs. A total of 219 women processors in northern Ghana were trained on the micro-scale production and use of the HQBF, and 370 households exposed to HQBF utilization through community demonstrations. For extensive dissemination of the technology, extension staff and NGOs operating in northern Ghana were trained as trainers. Formulation and nutritional quality of thirty-two bambara-based recipes have been validated to broaden the utilization base of the crop. Market outlets for HQBF were identified and bambara marketing margins determined along the supply chain. Impact studies showed evidence of increased demand for bambara for HQBF production, with processors having 12.5% increases in utilization levels.

A one-year extension was undertaken in 2005 under CPHP project R2986 with the aim to consolidate and sustain the uptake of bambara processing and utilization technologies for a wider impact on the rural poor. A video documentary on bambara production, processing and utilization in Ghana was produced. Training of master trainers was conducted for technical staff and students of research and tertiary institutions. A 51-page bambara recipe book (ISBN: 9988-0-3710-4) was produced and published. A colourful Bambara Food Fair was held for traditional bambara food processors, catering establishments and students.

5. *What is the type of output(s) being described here?*

Please tick one or more of the following options.

Product	Technology	Service	Process or Methodology	Policy	Other Please specify
X	X		X		

6. *What is the main commodity (ies) upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment*

The commodity upon which the output is focussed is the Bambara groundnut (*Vigna subterranea (L) verda*). The strategies adopted to promote the production and utilization of the crop through development of appropriate technologies and recipe formulations as well as the coalition partnership approach used in the development and dissemination of the innovations, are applicable to the other legumes, especially soybean, to help enhance household food and nutrition security and address livelihood constraints among the rural poor.

7. *What production system(s) does/could the output(s) focus upon?*

Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	High potential	Hillsides	Forest-Agriculture	Peri-urban	Land water	Tropical moist forest	Cross-cutting
X							

8. *What farming system(s) does the output(s) focus upon?*

Please tick one or more of the following options (see Annex B for definitions).

Leave blank if not applicable

Smallholder rainfed humid	Irrigated	Wetland rice based	Smallholder rainfed highland	Smallholder rainfed dry/cold	Dualistic	Coastal artisanal fishing
X						

9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (**max. 300 words**).

Promotion of appropriate grain legumes processing and utilization technologies has been acknowledged as effective means by which the ever-increasing problems of protein-energy malnutrition, household food and nutrition insecurity, and general livelihood constraints among the rural population in Ghana, need to be addressed. Effective repackaging and extensive dissemination of the outputs of the bambara project will therefore greatly enhance national initiatives on poverty reduction, improved child health and nutrition, and rural development. The potential impact of the bambara project has been well acknowledged in northern Ghana by farmers, processors, other stakeholders, as well as policy makers, who expressed the need for more extensive dissemination of the outputs, especially to the Upper East and Upper West Regions of the country, where the crop also constitutes a major source of livelihood for farm families. Extending the dissemination of the technologies and recipes developed on a wider scale to cover the Upper East and Upper West Regions, and ensuring self-sustainability will maximize the beneficial impact of the project for large numbers of poor people in the northern sector. In addition, soybean production and utilization are being currently promoted to address livelihood constraints in selected districts in the country under the Food Crops Development Project of the Ministry of Food and Agriculture. The technologies developed under the bambara project are applicable to soybean as well, and clustering this with the soybean project, and ensuring adoption on a wider scale, will help achieve a greater impact in addressing livelihood constraints in Ghana. Also there is a new international initiative, BAMLINK, on the “Molecular, environmental and nutritional evaluation of bambara groundnut (*Vigna subterranean L. Verdc*) for food production in semi-arid Africa and India” currently being undertaken as a collaboration between several African and Asian countries. The RNRRS outputs on bambara could be clustered with this initiative.

Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.

Although no output in the circulated list of RNRRS outputs clearly stands out to be clustered with the bambara output, the new recipes developed will promote preparation and sale of bambara foods as part of the informally vended and street vended foods in Ghana. The outputs can therefore be linked to the RNRRS outputs on Food safety – street foods outputs (R7493, R8270, R8433, and R8272).

Validation

B. Validation of the research output(s)

10. How were the output(s) validated and who validated them?

*Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the “who” component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation (**max. 500 words**).*

The project was undertaken in three main phases. The first phase was a purely technical product development phase where solutions to problems identified with bambara processing were sought. The second phase was the dissemination of research findings/outputs, particularly on the technology developed for the production of the high quality bambara flour (HQBF). The third phase was on the uptake/adoption of the technology. The validation approach was participatory and involved in all cases, various teams of participants drawn from the coalition, comprising partners from:

- ✓ The research organizations including the Food Research Institute, Home Science Department of the University of Ghana and the Natural Resources Institute of the UK
- ✓ Agricultural Extension staff of the Women in Agricultural Development (WIAD)– Ministry of Food and Agriculture (MoFA)
- ✓ Community-based NGOs in the northern region
- ✓ End-user groups including the small-scale bambara food producers, housewives, commercial enterprises and catering students.
- ✓ Other stakeholder representatives.

The following activities facilitated validation of the outputs:

- Baseline survey
- Impact tracking surveys involving the participatory appraisal tools
- Participatory technology transfer through training of trainers and field demonstrations
- Adoption survey
- Monitoring visits
- Quarterly coalition review meetings
- Stakeholder review meetings

The baseline survey covered interviews with small-scale women processors, commercial processors and consumers in northern Ghana, supplemented with secondary information from other stakeholders. The baseline survey established the benchmarks, the project start-up status of the key indicators including scale of processing, income levels of processors, sales, employment or existing jobs, consumer preferences, gender issues, market outlets among others. The survey was done by socio-economists from the partner research organizations in collaboration with the MoFA staff and partner community-based NGOs who were involved in training the end-users. The impact tracking system involves capturing changes within the benchmark indicators over the project

period. The system gives a snapshot of progress status at any point in time.

The development and transfer of the high quality bambara flour (HQBF) technology and the recipes were highly participatory involving the partner research organizations, extension staff of WIAD, the commercial partners, small-scale bambara processors and bambara food sellers, the NGO partners, staff of catering establishments, and Home Economics students of the Tamale Polytechnic.

The adoption survey was geared towards the women processors who were trained in HQBF as well as other technology transfer participants. For sustainability purposes the community-based NGOs were intensively involved. The adoption study established close to 70% adoption rate among the small-scale women processors. Demand for bambara for processing increased by 12.5% as a result of broadened utilization base.

The market identification and market linkages activities involved regular monitoring visits to supermarkets and few open markets to gather sales records and consumer /customer feed backs. More than 25 market outlets were established in Tamale, Accra, Kumasi and Techiman all in Ghana, for the commercial partners.

Mid-term and end-of-project Stakeholder Review Meetings brought together researchers, processors, donor representatives, policy makers, and staff of MoFA, NGOs and other potential users of the outputs, including students of the Polytechnics.

11. *Where and when have the output(s) been validated?*

*Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above (**max 300 words**).*

Validation for the outputs was undertaken in Ghana's semi-arid northern region where bambara is cultivated under smallholder rain-fed farming system by rural poor farmers, particularly women. Validation was carried out on different aspects and for various groups between 2000 and 2005 as follows:

- √ Baseline studies conducted between 2000 and 2003 have established:
 - Marketing opportunities for bambara and the constraints to the marketing system (2000 in the coastal belt and northern sector)
 - Production, processing, storage and utilization of bambara in Ghana and the constraints limiting the increased utilization of the crop validated in August 2000 in the southern, northern and Upper East regions.
 - Level of key performance indicators for impact tracking on the HQBF technology in northern Ghana in March 2003

- √ A method for the effective reduction in cooking times and enhanced utilization of bambara developed and validated in January 2001 in Accra.

- ✓ The HQBF technology was developed, and proven through participatory field tests in Tamale in June 2001.
- ✓ Eighteen extension staff and NGOs operating in the north were trained as trainers in Tamale in April 2003.
- ✓ Between June and September 2003, a total of 219 women processors trained on the micro-scale production and use of the HQBF, and community-based demonstrations conducted in the north for 370 participants on household use of the HQBF.
- ✓ The HQBF technology was successfully transferred to two commercial entrepreneurs in Tamale in December 2004, and 25 retail outlets identified for them in the Greater Accra, Ashanti, Brong-Ahafo and Northern regions of Ghana.
- ✓ From March 2003 to November 2004 a total of 23 bambara recipes have been validated, and a bambara recipe book published in 2005.
- ✓ Regular inception, quarterly and mid-term review workshops of the coalition, and final stakeholders' workshops, were held between 2000 and 2005.

Current Situation

C. *Current situation*

12. *How and by whom are the outputs currently being used? Please give a brief description (max. 250 words).*

The coalition partnership approach adopted in project implementation has greatly facilitated the uptake and application of both the technological interventions and the knowledge base outputs of the project, as shown below:

- ✓ Two commercial HQBF production units are now in operation in northern Ghana, with market outlets identified for the sale of their products.
- ✓ Small-scale bambara processors and bambara food sellers are currently using the technology for the production of high quality bambara flour in the preparation and sale of traditional bambara foods.
- ✓ Through field demonstrations conducted, households now have access to the knowledge of HQBF technologies for application in household utilization of bambara.
- ✓ Catering establishments are using the bambara recipes developed by the project in their business
- ✓ In terms of organizational uptake of knowledge, the project has trained Agricultural Extension Agent trainers and NGOs in northern Ghana, as well as catering students of Tamale Polytechnic, who

have acquired knowledge of HQBF production and utilization and are currently using it in their extension training activities.

- ✓ The video documentary on bambara production, processing and utilization, is being used by the Food Research Institute in promoting legumes processing and utilization in Ghana.
- ✓ The Home Science Department of the University of Ghana, the Nutrition Division of the Food Research Institute and the Women in Agricultural Development of the Ministry of Food and Agriculture are using the bambara recipe book produced by the project to promote legumes utilization in Ghana.

13. *Where* are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used (max. 250 words).

The outputs are currently being used only in Ghana. Specifically, the beneficial communities are concentrated mainly in northern Ghana, in the four districts where the project was implemented. The districts include Gushiegu-Karaga, Tolon-Kumbugu, Savelugu-Nanton districts, and the Tamale municipality in the Northern Region of Ghana. However, twenty-five market outlets for the sale of the High Quality Bambara Flour (HQBF) have been identified in four regions of the country (Greater Accra, Ashanti, Northern, and Brong-Ahafo regions). These outlets have been identified for sale of the HQBF from the factories of the commercial producers located in Tamale. The product is therefore being used to some extent, in these four regions of the country.

Knowledge-based outputs of the project have empowered the research organizations from the southern part of the country with additional knowledge on the processing and utilization of legumes in general, which they are applying in their normal research activities. The Tamale polytechnic students who were trained in the utilization of the HQBF are known to come from different parts of the country, and they are likely to be applying the knowledge in their various stations elsewhere in the country.

14. *What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading (max 250 words).*

Barely a few months to the end of project implementation an adoption and impact study findings established an effective utilization level of the HQBF technology 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 time of awareness, and consumer acceptability/quality were found to be statistically significant, using the Logit model. Respondents indicated 12.5% increase in demand for HQBF-based products. In terms of impact on organizational uptake of knowledge, the project has been able to train 18 Agricultural Extension Agent trainers 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. The impact and adoption studies 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. The HQBF market outlets identification study also found reliable markets for the product in four regions of the country, indicating a high potential for diffusion of the technology.

15. *In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? (max 350 words).*

The innovative coalition partnership approach adopted in the execution of this project constituted a good innovative platform for the effective promotion and adoption of the outputs. A fairly broad network of coalition partners, belonging to interested groups and organizations, was put in place to implement the project. The strategy here was that, with the active involvement of the important stakeholders, communication of research findings to the end-user was made easier, being tackled at the primary level. Research that is focused on an identified problem of a particular group is most readily received and adopted by the group who share ownership of the project.

Existing programmes and policies that also assisted with the promotion of the outputs include the Ghana Poverty Reduction Strategy (GPRS) and its associated programmes such as the Food and Agriculture Sector Development Policy (FASDEP) and the Presidential Special Initiatives (PSIs), among others. The GPRS placed emphasis on the transformation of the rural environment from its subsistence orientation to a commercially attractive, viable and dynamic sector. Specific policy recommendations on bambara production, processing and marketing generated by the project were under the broad policy framework on sustainable agricultural growth, poverty reduction, and private sector development.

With regards to the role of institutional structures, the Food Research Institute, which is the lead organization of the coalition, has over the years conducted a coordinated programme of applied research in all aspects of post-harvest research, as well as contributing to policy through advice to government on its national food policy, in line with its mandate. Institutional factors identified as important for the project include historical relationships involving previous collaborations that influenced the linkages, regulatory framework and formal working agreements that control the relationships between partners, restrictive regulations, market and communication barriers, as well as informal incentives.

In view of its vital role in technology generation and transfer for poverty reduction, the Food Research Institute requires capacity strengthening for effective knowledge generation and management. Human resource development, effective network and facilities for information dissemination and support for monitoring and evaluation, are the key factors for the success in project implementation.

Current Promotion

D. Current promotion/uptake pathways

16. *Where is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion (max 200 words).*

Promotion of the outputs is currently taking place mainly in the Northern Region of Ghana where project activities

were centred. However, the commercial partners who are using the technologies to produce HQBF for sale are indirectly promoting the utilization outputs through the sale of their products. The extension staffs of the Ministry of Food and Agriculture and NGOs, who were trained as master trainers in the north, are also promoting the technologies and recipes as part of their normal field activities in that area.

The outputs of the one-year extension phase implemented under CPHP project R2986 (ZB0379) have made it possible for promotion of the outputs to a limited extent in the Greater Accra Region in the south. Under the project a video documentary on improved bambara processing and utilization in Ghana was produced and launched, and a bambara recipe book published. These outputs are being used by the Food Research Institute and the Home Science Department at seminars and workshops to promote the technologies.

An interview was also granted and recorded by WRENmedia of the United Kingdom on the project. This recording has been placed on the AGFAX website <http://www.agfax.net/>, from which the outputs may be accessed globally.

17. What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional issues, those relating to policy, marketing, infrastructure, social exclusion etc. (max 200 words).

Within the project districts where the outputs were generated and disseminated, the institutional arrangements were such that the rate of adoption was not constrained in any way. However, due to the limited scope of the dissemination undertaken within the budgetary constraints of the project during its implementation, extensive adoption in other parts of the country, and outside, could not be achieved. The current barriers slowing down the adoption of the outputs are identified in terms of policy, inadequate infrastructure and social exclusion.

Policy: Although Government policy recognizes the development of the private sector as the backbone of the national economy, there are no policies in place for easy access to credit for entrepreneurs to be able to set up processing facilities to take on new technologies.

Infrastructure: The effective dissemination of information plays a vital role in improving agricultural systems in developing countries. Many agricultural practitioners in Ghana, and indeed the organizations forming the coalition, have limited facilities for information management and dissemination.

Social exclusion: There is little or no interaction between the small-scale processors or extension workers in the northern region and their counterparts in the other regions in the sector.

18. What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify perceived capacity related issues (max 200 words).

The selection of partner organizations and individuals to form the coalition for the implementation of the project was based on the effective dissemination and adoption of the outputs mainly in the northern region of Ghana. For a faster and wider scope of adoption of the outputs, there is the need to:

- Extend the dissemination to cover a few more strategic regions in the country and to link up with other institutions in other countries in West Africa
- Establish and institutionalize a wider coalition of partner organizations embracing all stakeholders in

all aspects of varietal development and selection, crop production, marketing, processing and utilization.

- In view of its vital role in technology generation and transfer for poverty reduction, the Food Research Institute requires capacity strengthening for effective knowledge generation and management, in terms of human resource development, effective network and facilities for information dissemination and support for monitoring and evaluation.
- Government policies need to put in place mechanisms for realistic interest rates on credit facilities to enable small-scale processors to acquire technologies for food processing.

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? (max 300 words).

The lessons learnt about the best ways to get the outputs used by the largest number of poor people include the following:

- Partnership approach and collective ownership of outputs: Technology development and dissemination that is approached as a partnership between the end-users and researchers is most readily received and adopted by the group who share ownership of the project. This is the innovative coalition partnership approach that was adopted in the technology development and dissemination. Within the lifespan of the project, the end-users tried the technologies and their difficulties were addressed. If organisations and partners with strong empathy for project aim and with the requisite expertise are identified and selected, coalition succeeds and results are achieved more effectively.
- Recognition: The contribution of each partner was recognized and appreciated. The traditional bambara processors were made to understand that their indigenous knowledge was very critical to the success of the project. They were made to feel free to suggest changes that would make the technology more effective for easy adoption. These were tried together, and greatly helped to come up with outputs that everybody felt part of.
- Addressing policy issues: The project directly addresses livelihood constraints that have a bearing on government policies on poverty reduction. It therefore became easy for government institutional structures to be relied upon to help promote the dissemination.
- Involving end-users in problem identification: The need for the development of appropriate bambara processing technologies to address the problems with utilization and consequent decline in production was first identified by farmers in northern Ghana who attributed the decline in production of the crop to lack of processing technologies capable of removing the drudgery involved in its utilization. Once the outputs are geared towards solution of their own perceived problems, adoption is made easier.

Impacts On Poverty

E. Impacts on poverty to date

20. *Where have impact studies on poverty in relation to this output or cluster of outputs taken place? This should include any formal poverty impact studies (and it is appreciated that these will not be commonplace) and any less formal studies including any poverty mapping-type or monitoring work which allow for some analysis on impact on poverty to be made. Details of any cost-benefit analyses may also be detailed at this point. Please list studies here.*

The Ghana Living Standards Survey Report of 2000:

Before the inception of the project, the Ghana Living Standards Survey Report of 2000 and the Demographic and Health Survey Report of 1998 by the Ghana Statistical Service emphasized the serious poverty situation in the northern sector of Ghana. Mean annual per capita income was reported to be lowest in the three northern sector regions comprising the Northern Region with an annual per capita income of ¢210,000 or £17.22, Upper East Region with ¢321,000 or £26.32, and Upper West Region with ¢206,000 or £16.89, as against an overall national mean of ¢527,000 or £43.20. The consequences of this situation on the nutritional status of the people were also evident in the surveys. The bambara project came under the “focused” poverty reduction category, addressing the issue of adding value to bambara, which is produced mainly by poor farmers, in order to resolve their livelihood constraints. The project hypothesis was that bambara producers will increase production as a result of having available improved methods for processing and utilising the commodity.

Impact/Adoption Studies:

Impact studies on poverty in relation to the development and promotion of bambara processing and utilization technologies were undertaken in the four project districts in the northern region of Ghana. 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. As part of the technology dissemination process from January 2003 to December 2004, the studies were carried out 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. 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. A sample of 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.

Socio-economic studies:

Socio-economic surveys were conducted in four selected project communities in northern Ghana to investigate the socioeconomic status of the bambara processors, assess the marketing potential of processed products and, most importantly, to establish the levels of all project performance indicators prior to the dissemination of high quality bambara flour (HQBF) technologies for impact tracking purposes. Bambara processing was found to be exclusively a female activity and a full-time job for most of the women interviewed. Processing was on a limited

scale, ranging between 1 - 10 bowls of bambara per day, and processing was done throughout the week (5 - 8 h a day). All bambara food vendors processed their own bambara flour to ensure good quality fresh flour, and the products were retailed directly to consumers. A quick assessment of the processing/food preparation activities of the women revealed daily gross margins of ₵3,000 to ₵100,000. This translates into monthly income of ₵84,000 to ₵280,000. Gross margins were highly variable, and the factors affecting gross margin on the bambara processing activity included geographical location, cost of grain and other materials, quality of grain, level of patronage, scale of processing, and management practices adopted by the processors. With the exception of processing levels, incomes and bambara recipes, all other performance indicators were starting from the zero-base.

Bambara Marketing Margins study:

Bambara marketing margins study was conducted in selected production and consumption centers in the Northern, Upper East and Brong Ahafo regions of Ghana, using a commodity subsystems approach. The study identified the distribution channels for bambara by tracing the movement of raw bambara grain from the producing centers to the consuming centers, examined the socioeconomic background of the various actors in the marketing system and gathered data on prices at the various bambara distribution channel for marketing margins analysis. Results indicate that bambara was a low volume traded product at both wholesale and retail levels as compared to other legumes and had limited distribution outlets. Approximately 35% of volumes of bambara produced was utilized by the producer-households either as food and/or seed and about 92% of the bambara producers sold their produce at their homes or local markets. Sales were usually effected five months after harvesting (May-June), when food was scarce and demand was high. A few (13%) bambara producers sold their produce to processors directly on the local markets and about 51% of producers interviewed depended solely on the activities of visiting itinerant traders. Producers who sold directly to local itinerant traders only constituted about 12% of the sample interviewed while 6% sold to retailers. The bambara marketing structure could be classified as an oligopsonistic one, having few buyers and consumers have little knowledge of bambara-based products. Pricing is based largely on negotiation/bargaining power, than with the true value of the product and the position of the producer in price formation is weak. The Total Gross Marketing Margin for bambara is estimated at 41.66% with Producer Participation Margin of 58.34%. Total Marketing Charges is approximately 11%.

21. *Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) (max. 500 words):*

- *What positive impacts on livelihoods have been recorded and over what time period have these impacts been observed? These impacts should be recorded against the capital assets (human, social, natural, physical and, financial) of the livelihoods framework;*
- *For whom i.e. which type of person (gender, poverty group (see glossary for definitions) has there been a positive impact;*
- *Indicate the number of people who have realised a positive impact on their livelihood;*
- *Using whatever appropriate indicator was used detail what was the average percentage increase recorded*

From the results of the impact and adoption studies conducted immediately at the end of the dissemination activities, the following have been recorded as positive impacts, directly or indirectly, on the livelihoods of the people:

- The effective utilization level of the High Quality Bambara Flour (HQBF) technology, a major output of the project, was 68%. Demand by consumers of bambara-based products from bambara food processors increased by 12.5% as a result of HQBF adoption. 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. Twenty-eight per cent of the 219 small-scale processors trained indicated that they were earning more income, with the adoption of the technology. Extra income was in the range of ₵5,000 - ₵10,000 per week per processor, 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. Shelf-life of bambara flour improved from 4 days to a maximum of one month when the HQBF technology is used, and expenditure on oil for frying reduced by a third. It was concluded that the rate of adoption of the technology was quite high, and the impact on income at this early stages of its introduction, was quite significant.
- The report also indicated that about 32% of those utilizing the technology regularly were using it for household food security only.
- A total of 219 small-scale processors have 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. This gives an indication of the number of households that could improve on their food and nutrition security through application of the technology. Children in northern Ghana were found more likely to be stunted (35-40 percent) than those in the other regions of the country. Similarly, more women in the northern sector were also found to be malnourished than those in the other regions. The high protein and carbohydrate content of bambara (as much as 25% and 60%, respectively) could have an enormous impact on the nutritional needs of northern rural populations.
- The HQBF technology has been transferred to two commercial entrepreneurs who were trained and equipped with mainly locally fabricated machines to produce the flour for sale. The enterprises involved were: T. Owusu Enterprise and the Bambara Processors' Association in Tamale.
- Formulation and nutritional quality of a total of thirty-two bambara-based recipes have been validated and used to train 32 master trainers in the four project districts in northern Ghana. The trained AEAs have further extended the recipes to households, catering establishments and cooked food vendors in the areas of operation. There was evidence at the bambara food fair organized as part of the end-of-project evaluation activities, that catering establishments in Tamale were using some of the recipes in their operations for more income.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? (max 300

words)

This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

The most significant environmental impact of the adoption of the outputs will be a drastic reduction in the rate of depletion of the scarce fuel wood resources in the semi-arid regions of West Africa. Consequently there will be less forest degradation. Commercially available high quality bambara flour removes the drudgery and the use of fuel wood involved in the preparation of traditional bambara foods. Currently, cooking bambara is an arduous task when the effort and time required to process the beans for the preparation of traditional foods, together with the large quantities of water and fuel that are needed, are considered. Reduced use of fuel wood also introduces an additional advantage of reducing environmental pollution through wood burning.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? (max 100 words)

There are no adverse environmental impacts of the technology. The only waste by-product in the production of the flour using the technology is the hulls obtained after dehulling and winnowing. The hulls contain the germ and some pieces of broken beans, making this waste by-product quite nutritious for use in animal feed formulations, even at the household level. There are therefore no waste disposal problems in the adoption of the technology.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? (max 200 words)

The technology developed produces readily-available, relatively shelf-stable intermediate flour for the preparation of several foods that serve as main dishes for the people in the target areas. If the technology is widely adopted, flour produced and stored from previous harvests will be available to help the communities cope with the effects of climatic changes that result in draught and consequent crop failure. Several new recipes have also been developed as a major output of the project; and their adoption will introduce some degree of flexibility in the food habits of the people, providing them with more choices of bambara-based foods for enhanced nutritional status.