Eval Inv. 1.4.13

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31st October

Gail Motsi,
ROSA,
IDRC
Braamfontein.

Dear Gail,

Herewith my final report (hard copy and disk).

You will remember the "Concept Virus" I had the last time around.....that has played a bit of havoc with final procedings and delayed matters somewhat. Anyway, I purchased an updated anti-virus programme and it all seems clean and fresh now.

The disk is in Microsoft Word and Excel - I have written the file names and contents on the disk label.

Kind regards,

Mike.

M.I.Murray.

A SURVEY OF COMPLETED IDRC PROJECTS
IN SOUTHERN AFRICA

COMMERCIALISATION CASE STUDY
-AGRI-INDUSTRY

An Assessment of IDRC Projects Nos.

92-1007	*Phosphate Rock Blends: Developing Local Alternatives (Zimbabwe).*
85-0223	*Grain Dehulling - Phase I (Malawi).*
90-0267	*Grain Dehulling - Phase II (Malawi).*
92-1451	*Starch Adhesives (Malawi).*

M.I.Murray
Johannesburg
1997

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LIST OF ACRONYMS USED IN REPORT

AFC	Agricultural Finance Corporation (Zimbabwe)
CAD	Canadian Dollar
ESAP	Economic Structural Adjustment Programme
IDRC	International Development Research Centre
IMR	Institute of Mining Research
LDC	LessDeveloped Country
MIRTDC	Malawi Industrial Research and Technology Development Centre
MK	Malawi Kwacha
MOA	Ministry of Agriculture
NGO	Non-Governmental Organisation
ROSA	IDRC Regional Office for Southern Africa
SADC	Southern African Development Community

SIGNIFICANT PROJECT FINDINGS

1. PHOSPHATE ROCK BLENDS: DEVELOPING LOCAL ALTERNATIVES (ZIMBABWE)

- **Significant Impact Potential** *(Potential impact could be to increase cropping output by more than $120m.CAD p.a.. If even 20% of potential was realised, it is possible that the Project outcomes could generate sufficient increased food production for 0.5 m. people. Such a magnitude of potential impact represents a possible unique achievement in international development research).*
- **Need for a Commercial Feasibility Study** *(The report highlights the need for a full and complete study to be conducted into the feasibility of the emergent strategy for the commercialisation of this Project).*
- **Research - Driven by Market Mechanism or Technology?** *(There was an absence of even preliminary financial and marketing appraisals within the Project programme. What is required in agricultural development research is for more account to be taken of the of the social, economic and physical environments within the Project context. The research must be guided by the true needs, attitudes and resource availability of target beneficiaries).*
- **Function Before Form** *(Thorough project preparation, including the development of a business plan would have crystallised strategic approach, functions to be performed and consequently the human resource requirements of the research team).*

2. GRAIN DEHULLING (MALAWI)

- **Project Reach and Impact** *(Project reach and impact are inert and in danger of disappearing altogether if the technology remains unexploited. The Project has significant potential impact to improve Malawi food security through increased usage of hybrid maize varieties).*
- **Agricultural Research Must be Appropriate to Real Needs** *(An agricultural research project must be appropriate to most farmer needs and requirements, or to smallholder farming systems, or be affordable to the vast bulk of rural households. If it is not, there are dangers of it falling into the development trap of delivering intervention to where it was deliverable, rather than where it was needed).*
- **The Need for More Complete Project Preparation** *(A socio-economic survey should be the departure point for projects of this type. A wider pre-project approach would provide for better preliminary appraisal of likely project feasibility and a broad understanding of local socio-cultural issues involved).*

3. STARCH ADHESIVES (MALAWI)

- **Project Impact and Reach** *(To date, the only beneficiaries of the project have been the project's associated research team).*
- **Lack of Sufficient Project Planning and Appraisal** *(The absence of a more thorough investigation at the project proposal stage has meant that the Project has deviated from its original values and ideals. Experience from this Project emphasises the need for accurate project appraisal and thorough project preparation).*

SUMMARY OF PROJECT IMPACT

A) PHOSPHATE ROCK BLENDS: DEVELOPING LOCAL ALTERNATIVES (ZIMBABWE) (92-1007).

Beneficiary/Potential Beneficiary	*Benefit Type*	*Mechanism*	*Actual Extent Benefitted*	*Potential for Future Benefit*
Zimbabwean research capacity	Training, International exposure, international links, knowledge	Conducting research, publications, conference presentations, travel.	Masters graduate. Various visits to Canada Publications	Ongoing good potential
Institute of Mining Research/U. of Zim.	Image development and maintenance	Participatory research with Govt. and community	Non-measurable	Ongoing in medium term
U.of Guelph	Image development and knowledge	Visits, participatory research publications	Various	Ongoing in medium term
Nation of Canada	Development of North/South type foreign relations	Commitment through financial and technical assistance	Non-measurable	Continuous potential
Nation of Zimbabwe	Development of potenial strategy option for executing Govt. agricultural dev.policy	Possible mechanism to improve smallholder access to fertiliser		Potential of expanding agric. production by up to $120m CAD p.a.
Rural residents of Zimbabwe Communal Areas	Expansion of access to food and economic opportunity	Increased farm out put and rural etrepreneurial activity		1800 micro blending units in rural areas could supply fertiliser inputs to expand food production to feed 2.5 m. people (700000 tons maize).

SUMMARY OF PROJECT IMPACT

B) GRAIN DEHULLING PHASES I & II (MALAWI) (85-0223 & 90-0267)

BENEFICIARY/POTENTIAL BENEFICIARY	BENEFIT TYPE	MECHANISM	ACTUAL EXTENT BENEFITED	POTENTIAL FOR FUTURE BENEFIT
Malawi research capacity	Training, international exposure and links,knowledgd	Conducting research, travel, conferences,publications.	One year training overseaes (1) 6 papers presented. At least 3 conferences.	Good, but dependent on external funding
Farm Machinery Unit	Community image	Seen to be helping the community	Non-measurable	With funding - good potential Without funding - NEGATIVE
Canadian Govt.	Development of North/South type foreign relations	Commitment through financial and technical assistance	Non-measurable	Continuous potential if assistance is appropriate. Dangers of NEGATIVE potential if Project status quo prevails.
Malawi Govt.	Possible contribution to rural development strategy	Possible mechanism to improve rural access to food		Potential to contribute towards an expansion of Malawi smallholder food production of over 100% or by a further 850000 tons.
Rural communities in Malawi	Expansion of food supply and entrepreneurial development	More efficientdehulling,increased disposition towards hybrid seed, development of dehulling smallbusiness.	8 experimental dehulling operations Probably up to 2000 households having made use of these dehulling services.	Theoretical potential for up to 2500 dehullers to service 640000 smallholder households.

SUMMARY OF PROJECT IMPACT

C) STARCH ADHESIVES (MALAWI) (92-1451).

BENEFICIARY/ POTENTIAL BENEFICIARY	BENEFIT TYPE	MECHANISM	EXTENT OF BENEFIT	POTENTIAL FOR FUTURE BENEFIT
University of Malawi research capacity	International exposure and linkage, knowledge,training	Conducting research, publications,conference presentations,travel.	M.Sc. student,Canadian conference,Ugandan conference, Crop Sciences Network Workshop, UOM Conference.	Good
Malawi industry	Alternative supply route for adhesives	Possible local production	FOREX savings potential	Limited
Small cassava producers	New market, improved price			Very limited

A SURVEY OF COMPLETED IDRC PROJECTS IN SOUTHERN AFRICA
COMMERCIALISATION CASE STUDY - AGRI-INDUSTRY

1.0 BACKGROUND.

Over the past 25 years, the IDRC has supported more than 5000 research projects internationally. This study was initiated by the Evaluation Unit of the IDRC in order to expand the IDRC knowledge base of what degree of benefit and impact its research investment might have had. It is important for the IDRC to understand the degree of impact of the research it supports. Such information can only enhance future IDRC operations - whether this be for better understanding of Canadian intervention in international development processes; for learning how it may be impacting research capacity within developing countries; or for improving future impact assessment of development research.

A survey of completed IDRC projects has been initiated internationally, covering 4 areas of organisational operation (Commercialisation, Information and Communication Technology, Policy, and Public Good/Quality of Life). This report is one of a series of appraisals of projects that constitute Southern African projects conducted for the "Survey and Assessment of IDRC's Completed Projects (Project No. 94-0821/02287). This particular report presents an assessment in the area of Agri-industrial/Agri-business Commercialisation.

The overall objective of the Survey is to assess the outcome of IDRC investment. Specific objectives are to:

a) identify research outputs resulting from IDRC funding which have led to or could lead to *significant impact* on target beneficiaries and other communities; and

b) identify factors that have facilitated or hindered the application of relevant results.

To a lesser extent, the Survey is also to be used for decisions regarding the possible further application of Project results and for recommendations for any further IDRC funding in this regard. Furthermore, the Survey is to identify any features of IDRC projects that might lend themselves to the organisation's public communication strategies.

This particular report covers Survey results in respect of the following Projects:

92-1007 Phosphate Rock Blends: Developing Local Alternatives (Zimbabwe).
85-0223 Grain Dehulling - Phase I (Malawi).
90-0267 Grain Dehulling - Phase II (Malawi).
92-1451 Starch Adhesives (Malawi).

As the 2 Grain Dehulling Projects were considered as one initiative, this omnibus report essentially covers 3 Projects, each of which represents a separate case study with its own section in this report. All Projects chosen for the Southern African section of the Survey were workshopped by the respective Consultants who researched them. The results of this workshop were then incorporated into an overall Synthesis Report covering all Southern African IDRC Projects selected for the Survey.

2.0 METHODOLOGY

The Consultant visited Zimbabwe and Malawi in May and June of 1997 to carry out the necessary fieldwork for the purposes of this assessment. In the absence of a formal monitoring and evaluation element to the research Projects under review, background fieldwork comprised mainly of a review of available IDRC project documentation; the identification of relevant issues; interviews with Project personnel; inspections of plant and machinery to understand the technical processes involved in the Project; interviews with identified interest groups and other relevant parties; and the identification and sourcing of appropriate secondary data. In addition, except for the Starch Adhesives Project (Malawi), the Consultant was taken by Project personnel into rural areas in order to be shown traditional technologies and systems. Comparisons could then be made with applied technologies from the examined IDRC Projects.

Information obtained from this fieldwork was later synthesised and incorporated into this report. Synthesis of field data was guided by an evaluation framework, a concept document, and various other documentation provided by the IRDC. Copies of this guideline documentation are included separately in the overall Synthesis Report.

3.0 PHOSPHATE ROCK BLENDS: DEVELOPING LOCAL ALTERNATIVES (ZIMBABWE) (IDRC PROJECT 92-1007).

3.1 BACKGROUND TO THE PROJECT.

Although Zimbabwe has an established agricultural sector, the dual nature of this sector reveals contrasting differences in fertiliser utilisation between commercial farmers and smallholder agriculture. The smallholder sector accounts for more than 85% of all farmers and these agriculturists are resource poor. While many smallholders make use of some fertiliser, inequalities regarding access to fertiliser result in inadequate and inappropriate application of the commodity.

Zimbabwe does produce commercial phosphate fertiliser from indigenous resources, and such phosphate input is important to that tropical country's crop nutritional requirements. Most phosphate deposits within the country are of igneous origin, and are therefore highly insoluble unless treated by chemical means. Of known phosphate deposits within the country, the major deposit at Dorowa is the only one currently worked. Proven reserves at this location are probably sufficient for over 40 years at present production levels. Phosphate concentrate is transported to the Zimphos plant just outside Harare where it is acid treated to produce single and triple super phosphates. In turn the triple super phosphates are used in compounds or to produce double super phosphate.

The cost of fertiliser is considered to be an inhibitor to fertiliser usage and food crop production in communal areas of Zimbabwe, where clearly inadequate usage of fertiliser is made. However, in this regard, recent international

research has shown that it is possible to reproduce the necessary acidulation reaction to phosphate rock by blending and compacting phosphate rock with acidulating commercial fertilisers *in situ*. In turn, such a process can decrease the high price of fertiliser without significantly compromising fertiliser efficacy.

The IDRC therefore funded a collaborative applied research project in Zimbabwe to develop an envisaged new blended phosphate fertiliser product for the local (and possibly export) market. The rationalisation behind such a product development programme was that the possible resultant fertiliser would represent a fertiliser product that offered better value for money, particularly in the communal sector.

The Project was to involve the Institute of Mining Research (University of Zimbabwe), Chemplex Corporation Ltd., the Department of Research and Specialist Services, and, as a Canadian partner, the University of Guelph. Funds were allocated by the IDRC in 1992 (the initial funding amount was $388950 CAD but was supplemented by a further $12895 CAD in 1996) and the project was to terminate on the 31st December 1996.

Project personnel had prepared a draft copy of a final report on the Project, but this was withheld from the Consultant for correct reasons of protocol. This assessment has been prepared without sight of that report.

A schedule of people interviewed, and of documents referred to, is attached as Appendix 3A.

3.2 PROJECT OBJECTIVES (AND INTENDED OUTPUTS).

As project objectives and intended project outputs are a core reference to any project assessment, they are listed separately below:

3.2.1 Project Objectives

While the overall goal of this project was to improve soil productivity and food production in Zimbabwe through the utilisation of locally available phosphate products, the Project Summary lists specific project objectives as having been:-

a) to develop agglomerated phosphate fertiliser blends using Dorowa rock phosphate blends and local commercial fertilisers;

b) to scientifically establish the basis of reaction processes between phosphate rock and selected soils (within blends with commercial fertiliser and without);

c) to determine the agronomic effectiveness of phosphate rock blends on granite soils over three different agricultural zones, using maize as an indicator crop; and

d) to establish the preliminary feasibility of implementing the production technology that would be developed for phosphate rock blends.

3.2.2 Intended Project Outputs

Project documentation lists expected outputs of the project to have been:

a) At least one formulation for a phosphate fertiliser blend.

b) A process for improved usage of phosphate resources at Dorowa.

c) A pilot scale process for the recovery of apatite from material being currently discarded at Dorowa.

d) An agronomic evaluation of the new blends compared to commercially available fertilisers.

e) A report on the preliminary feasibility of replicating the researched process on a commercial scale for the benefit of smaller farmers. Such a preliminary socio-economic evaluation would include a review of market data; an analysis of likely production costs; the establishment of agricultural economic viability of potential smallfarmer use of phosphate blends; and likely environmental impact.

f) One agronomist trained in Agrogeology at Masters level.

g) An improved understanding of the techno-chemical processes involved in phosphate blending.

h) The strengthening of the IMR (particularly through interaction with the University of Guelph) in the field of phosphate characterisation.

i) Human capacity development in the areas of management decision making, strategising the technological scaling-up process to production levels, and agronomic data analysis.

j) The largest group of potential beneficiaries of the project would be communal area farmers in Zimbabwe (80% of who are women).

3.3 PROJECT OUTPUTS

A feature of this research project has been the directional difference between the intended outputs and unintended outputs (and potential outputs). Such a feature has arisen from an evolutionary focus of the project over its initial lifespan, from the intended development of a new "value for money" commercial fertiliser product to a product concept more akin to the enhancement of traditional practices of improving soil fertility.

3.3.1 Intended Project Outputs

To date, the main intended Project outputs have been somewhat disappointing at face value. Although increased fertilisation rates in respect of all developed blends showed increases in maize output over controls, the number of products tested (over different natural regions with different application rates, variable climatic seasons and within various crop rotations) introduced too many variables for a definitive answer to be given to research that covered only 3 growing seasons. The researchers, with the benefit of hindsight, now consider that significant results would only be available over 10 years. However the Project substantiated one thing - that blended phosphates definitely lead to a generic positive enhancement of soil fertility.

The compactor at Zimphos near Harare regularly provided significant quantities of different blends of fertiliser for the planned field trials, and the disc pelletiser installed at the IMR similarly produced pelletised blended products for testing. A series of greenhouse and field experiments were conducted to evaluate the agronomic effectiveness of compacted phosphate blends (CPB) and pelletised phosphate blends (PPB) using varying proportions of Dorowa phosphate rock and commercially available triple superphosphate fertiliser. Five PPB's and five CPB's of various blend strengths (plus non-acidulated Dorowa phosphate and 100%-acidulated triple superphosphate) were tested in the field at 3 Government research stations situated in different natural regions. In addition, greenhouse trials were conducted, as were on-farm trials in the communal areas of the Project area.

While the planned-for more technical outputs of the Project were generally attained (e.g. formulation of blends, development of pilot processes, expansion of the Zimbabwean research capacity, improvement in the understanding of the techno-chemical processes involved, etc.) the Project's weakest area was the lack of a preliminary feasibility plan for subsequent, more commercialised implementation of the process.

Project research also demonstrated that up to 66% recovery of phosphate was possible from currently discarded slimes at Dorowa (25% of rock mined is discarded). Such research results even gave rise to consideration that phosphate could be recovered in future from Dorowa flue dust.

3.3.2 Unintended Project Outputs

Good qualitative contact was established with farmers in the Buhera communal area in the course of the Project. Apart from the farmers deep interest in the tested products, and their willingness to contribute land, resources and labour to the research process, informal communication with the community exposed the researchers to an understanding of prevailing farming systems and farmer preference for cattle manure to enhance soil fertility. Such practices injected a new dimension into the greater Project, and as manure is phosphate deficient, gave rise to the new concept of "phospho-composting". Such "phospho-composting" was the research topic of the graduate student from the Dept. of Soil Science and Agricultural Engineering who, as part of the Project, was selected for a Masters programme at the University of Guelph. It is this concept of adding phosphate to traditional manure-based compost that provides the Project with its greatest possible future *impact (discussed later on in the report).*

A further implementation concept that has now evolved from the Project, is to set up a number of micro blended fertiliser manufacturers and distributors within the communal areas. If that could be done, then rural entrepreneurs would be developed, employment created, and money circulated within the areas of the country that house not only the majority of the population, but the poorest of the poor. In addition, if such micro units were so located that smallfarmers could personally collect their own fertiliser requirements, then most of the currently experienced *distribution* problems would be overcome.

Furthermore, by training farmers to "enhance their manure" by adding phosphate blends, future extension workers could operate within existing tried and traditionally acceptable farming systems and thereby promote the adoption

of the new product. By working within acceptable farming sytems and resource ownership, such extension would be far more effective than it would be if small farmers had to change to completely new farming systems.

3.4 PROJECT INPUTS

The following project input factors were a feature of, or had a significant effect on, the Project being assessed:

3.4.1 Project Preparation

While the overall Project impression was one of a high standard of research and resource input quality, aspects of poor project preparation placed this Project at potential risk from the beginning.. Only the qualities of enthusiasm and socio-cultural sensitivity of the residual members of the project team have allowed the Project to evolve to a stage where it now represents substantial impact potential. Specifically, poor project preparation occurred in the following areas:

a) Technological origins of the research project.

The initiation of this applied research project originated from technological beginnings, in that it was formulated from the end stages of another project (Agrogeology II - Tanzania [87-1035]). In addition, Zimbabwe was chosen as a host country because of it's "existing mining and processing infrastructure which will not only maximise the chances of success of the research, but also considerably reduce cost" (IDRC Project Summary). The potential dangers of such an approach are that the agricultural research product might have been inappropriate to farmer needs and requirements, as well as smallholder farming systems. Moreover, the technical outputs of the Project might not fit into the strategic capacity of institutions intended to act as implementing agents.

A preliminary socio-economic survey should have been the departure point for the programme, i.e. to provide a market and a smallfarmer needs orientation for the strategic planning of both the research programme and the implementation of its results. Such a pre-project approach would not only have guided Project strategy, but would have identified the need for a more appropriate (and not solely technical) project team profile.

This severe omission from the preparation stage of a potentially commercial Project could have rendered techno-chemical research outputs moribund for lack of an implementation strategy. Any research should be market situation related, and a preliminary market appraisal and feasibility study should have been an essential first phase of the Project. Information from such a study would have guided research direction.

b) Lack of understanding for the need of a balanced programme of farmer support services.

A preliminary survey would have also highlighted the complexities and interdependent nature of the various necessary elements in any small farmer support programme e.g. inputs, credit, marketing, extension, training, infrastructure, etc.. The Project's initially intended intervention in only <u>one</u> area (the initial only real benefit of the Project was to have been potentially lower fertiliser prices) would not necessarily have promoted expanded cropping

output alone. Investigation into other constraints to fertiliser usage would have indicated that other support factors such as physical access to fertiliser supply, credit availability for fertiliser acquisition, extension capacity, etc., are also important to promoting fertiliser usage. Such issues should have been addressed within the Project so that a more holistic approach could have been followed to protect the Project from dangers of failing in the market place.

3.4.2 Project Team Human Resources

The research Project Team (composed of representatives of the Institute of Mining Research, University of Guelph, Chemplex, and the Dept. of Research and Specialist Services) was ineffective as such, reportedly due to a lack of committed and sustained level of co-operation. For example, the representative from Chemplex left that company's employ and his position on the team was not refilled by the Company. Therefore the intended Chemplex function(and particularly the role of Chemplex in the intended socio-economic study) was never carried out.

Similarly, the Department of Research and Specialist Services reportedly did not make the services of an Economist available to the Project as planned, and the residual project team had to employ the services of an Agricultural Economist from the University of Zimbabwe (Dr. J.Rusike) to assist in field-level agronomic appraisal of the various phosphate blends. The absence of a permanent Economist on the team (together with the apparent ineffectiveness of Chemplex and the absence of a Mining Processing Engineering capacity within the Institute) has restricted the Project's outputs to date particularly within the expected output areas of blended fertiliser production cost analysis, assessment of financial viability, development of a preliminary marketing plan, and potential impact of lower-priced fertiliser. Staff resignations within the Dept. Research and Specialist Services (including the soil scientist who conducted experiments in Guelph during a Canadian visit) also impeded the progress of intended inputs.

A positive note however, appears to have been the twinning of human resources between the Universities of Guelph and Zimbabwe (through the IMR). Not only has co-operation between the two institutions been reportedly excellent, but in Dr. P.van Straaten (who has a substantial amount of experience in working with African communities) of the University of Guelph, the Project was fortunate to have someone with an appreciation of the importance of working with target communities, being sensitive to their needs, and of needing to research within a n existing socio-cultural and farming system framework. This sensitivity was further supplemented by field officer personnel within the IMR who coincidentally originated from the Buhera district (the area of Zimbabwe where the phosphate is mined and where some on-farm trials were conducted). This "humanisation" of the research process (something that the original proposal probably lacked) augurs well for future potential outputs, and direction, of the Project.

3.4.3 Operational Context

The residual local project team was very complimentary about the degree of flexibility allowed by the IDRC once the research Project was underway, although they said that this contrasted with the IDRC's rigidity and prolonged administrative process prior to commencement of the Project.

The flexibility mentioned included experimentation work to be allowed with different binding agents (such as groundnut stover, lime juice, molasses and sorghum beer) for the pelletised products. Such flexibility also allowed the emergent strategy of "phospho-composting" to evolve. This evolution of strategy resulted from the research process, plus consultation with communal farmers together with the innovativeness and socio-cultural awareness of the researchers.

3.4.4 Project Inputs: General Comment

The Consultant specifically questioned the local Project personnel on the question of adequacy of project resources, and was informed that there had been no constraints in this regard. In particular, funding of the Project was considered to be adequate.

3.5 PROJECT REACH AND IMPACT.

Apart from a group of farmers (less than 20) in the Buhera district, and the involved research practitioners (mainly from academic institutions), this Project has yet to achieve any reach and impact. Nevertheless, it is considered that the potential outcomes from the Project should still have a significant impact within Zimbabwe if not within the region as a whole.

In order to understand the magnitude of the potential impact of this Project, one has to examine the Zimbabwean cropping sector, understand the market dynamics within the fertiliser industry, and analyse the probable costs and benefits of implementing phosphate blend technology. As these areas were not covered by the research Project, a preliminary analysis and appraisal have been prepared by the Consultant:

3.5.1 The Fertiliser Market in Zimbabwe

a) *Market Background*

The Zimbabwean economy is strongly agricultural-dependent. Its farming sector provides for some 25% of the country's formal sector employment opportunities, and 14% of national Gross Domestic Product. The structure of the agricultural industry is however dualistic, as is reflected in the country's land distribution patterns (43% of agricultural land is farmed by commercial farmers and 57% of land is used by farmers in communal and resettlement areas). Moreover, at least 74% of communal area land is contained within the relatively semi-arid and poorly soiled Natural Regions IV and V (see map in Appendix 3B). As a consequence, communal area farming systems have largely become environmentally non-sustainable due to demographic and livestock pressures as well as continuous cultivation of fragile soils without sufficient fertilizer to replenish soil fertility.

Despite natural resource disadvantages, the performance of Zimbabwean small-holder agriculture immediately post-Independence was impressive. Retrospectively though, this is thought to have been due to increases in area cropped rather than increases in yields and productivity *per se*. The early gains of the smallholder sector have not been

maintained and output in recent years has actually declined. Apart from some adverse climatic years, there have been a number of other contributory factors, including:

i. gradual erosion of commodity prices in real terms;
ii. declining effectiveness of State-provided support services (such as research and extension);
iii. a reduction in statutory agricultural marketing support activities;
iv. a slow-down in land reform and resettlement programmes due to budgetary pressures;
v. a realisation that the initial success of smallholder farmers was due to successes amongst the top 10% located in higher rainfall areas with better access to support services;
vi. a decrease in Agricultural Finance Corporation short term credit to smallholders after 1985 due to loan repayment failures; and
vii. the adoption by the Government of an Economic Structural Adjustment Programme (ESAP) in 1991 to move the economy into a more market-orientated mode (this has placed specific strains on the agricultural sector, particularly the smaller farmers who have not the economies of scale potential to weather such changes).

b) Market Size

Zimbabwe consumes some 0.5m. tons of inorganic fertiliser per year, of which Nitrogen accounts for about 49%, Phosphate 23%, Potash 17% and Sulphur 11% of total nutrients consumed. Historic trends of fertiliser consumption, by agricultural sector, are shown in Table 1 of Appendix 3A.

The commercial farming sector accounts for about 350000 tons annually (70% of total consumption) although since Independence, commercial consumption has decreased. This is due to the combined effects of drought and a swing back to tobacco following the diversification of crops that took place as a result of tobacco sanctions during the UDI era.

The smallholder sector accounted for only 8% of fertiliser consumption prior to Independence, but this figure rose to a peak of 30% in the mid-Eighties. This was due to a re-orientation of national farming policy, and public sector farmer support services. Since then however, consumption has dropped to some 20% or about 100000 tons annually. In addition to smallholder direct fertiliser consumption, the Zimbabwe Government has made significant quantities of fertiliser available as a component of a smallholder drought relief programme (such "drought relief fertiliser" amounted to 110800 tons in 1992/93, 68895 tons in 1993/94, and 18590 tons in 1994/95).

Most fertiliser is used by both sectors within the major cropping area of Mashonaland (this Province accounts for 76% of commercial sector consumption and 75% of smallholder usage). Some 50% of total fertiliser usage is attributed to maize production within the country. Tobacco (12%), wheat(11%) and cotton (6%) account for most of the balance.

c) Fertiliser Application Rates

Despite average fertiliser application rates within the smallholder sector (less than 50 kg./ha.) being significantly less than the 700kg./ha. application levels of the commercial farming sector, SADC (15kg./ha.) and African countries (20kg./ha.) are generally in a worse position. The world average rate of application is 95kg./ha.

d) Factors Affecting Consumption

i) Climatic Conditions.

Fertiliser usage represents a major financial risk to all farmers but particularly within areas of marginal rainfall. Consequently the majority of small farmers practise "response fertiliser application" and will only use fertiliser after rainfall has been adequate and the crop established. This practice not only mitigates against fertiliser effectiveness but can also apply awkward pressures on fertiliser supply and distribution. In addition, such difficulties regarding physical access invariably lead to inappropriate usage of non-suitable compounds.

ii) Fertiliser Availability.

The Zimbabwean fertiliser industry capacity is lower than peak demand periods (Sept.-Nov.) and any plant breakdown during this period (which can be a problem because of aged machinery and plant) results in supply shortages which cannot be remedied quickly by imports. Furthermore, stockpiling is not an attractive contingency option to suppliers due to high interest rates that have been triggered by ESAP.

Smallholder accessibility to fertiliser is particularly restricted by weak transport and communications networks. Spply companies dislike dealing with relatively small orders. Transporters tend to have aversion to poorly maintained dirt roads that can become quagmires during the rains and inoperable because of low-lying bridges and causeways. Smallholder physical access to fertiliser can therefore be a very real problem, and although many smallholders have organised co-operative buying groups (usually through "farmer associations") to redress some of the administrative problems, timeliness of deliveries can still be a very real problem.

iii) Fertiliser Credit

Smallholder access to fertiliser is further complicated by the availability of credit. While commercial farmers normally have the net capital worth to obtain production credit from banks or the Agricultural Finance Corporation, the smaller farmer is disadvantaged. This was clearly demonstrated by the AFC policy of championing short term credit for smallholders in the early 1980's.....and smallholder fertiliser usage increased nearly fourfold during that period. Conversely, due to poor loan repayment performance, smallfarmer production credit has been reduced substantially since the mid-1980's (the Agricultural Finance Corporation granted more than 98000 loans to smaller farmers in 1986, but this level of credit fell to 21000 loans by 1993) contributing to a shrinkage in fertiliser consumption by this sector of the market.

iv) Fertiliser Prices

Farmgate prices for fertiliser can vary greatly due to differences in distribution infrastructures available. Smallfarmers in communal areas are the most poorly served by transport infrastructure in the country. Consequently they have to pay an average of more than a 40% mark-up on distributor prices to secure the commodity (commercial farmers on the other hand have to pay an average of 16%). The Consultant was even told of instances where some smallholders had to virtually pay double the market price for fertiliser delivered to their area.

Apart from high distribution costs, Zimbabwean fertiliser costs are in any event high by international comparison. Being a land-locked country, landed prices would be high for the imported product, despite recent trade liberalisation moves. In addition, frequent breakdowns of aged plant and machinery, plus high interest rates and currency devaluation, have placed substantial upward pressures on domestic costs of production. Since Independence in 1980, the Zimbabwe Dollar has depreciated by 92% against international currencies, and within this period the domestic price of Compound D fertiliser (taken as an indicator) has increased more than ten-fold.

v) Agricultural Produce Markets.

If the smallholder does not have access to seasonal credit, the normal other manner of acquiring fertiliser is by paying for it out of the previous season's cropping proceeds. As a result of ESAP and consequent deregulation of agricultural marketing, smallholders invariably have to resort to selling any surplus produce to local dealers for low prices, thus affecting the quantity of fertiliser that is able to be purchased.

vi) Farmer Extension and Training.

Fertiliser-linked extension is either performed by AGRITEX or by fertiliser company agronomists, and except in the commercial farming sector, such extension is woefully inadequate Only one AGRITEX official is available on average to look after each District, and only 16 agronomists cover the smallholder sector of the country. Conversely, there is a strong need for an extension drive and the implementation of an agronomic training programme if fertiliser usage is to be increased.

3.6 EMERGENT PROJECT FERTILISER STRATEGY FOR SMALLHOLDERS

It is against such a background of significant constraints to smallholder usage of fertiliser, that the Phosphate Blends Project presents substantial potential impact in the future. Fertiliser is likely to remain a scarce and expensive commodity for many small-scale farmers unless issues such as the ineffective distribution network, the absence of appropriate fertiliser application rates and application methodology, price, and availability are all not redressed.

Policy measures to enhance the production, distribution and small farmer usage of fertiliser and make the commodity generally more accessible both physically and economically, are urgently required to boost food production in communal areas of the country. Such a goal has been identified by official Government policy (Zimbabwe's Agricultural Policy Framework : 1995-2020).

A concept of developing up an appropriate network of micro fertiliser manufacturers and distributors (utilising phosphate blending technology from this Project) would address the following pertinent issues identified within this paper:

a) Decreasing the price of fertiliser.

b) Making fertiliser more accessible to the small farmer (the supplier would be situated within the relevant farming community who would organise their own fertiliser collection).

c) Making available area specific fertiliser products (appropriate to localised farming needs).

d) If the usage of such blended products were promoted to be used in conjunction with existing traditional manure compost fertilisation, extension capacity requirements would be reduced as "phospho-manuring" would be incorporated into existing socio-cultural attitudes and farming system practices.

e) Creation of rural employment.

f) Expansion of communal area food output to provide for greater food security.

g) Development of commercial activity within rural areas (which could have a further localised economic multiplier effect.

3.7 PROJECTED ECONOMICS OF OPERATING A MICRO BLENDING UNIT.

In the absence of Project costing studies, the Consultant has made a preliminary estimate of the possible cost of operating an envisaged micro blending unit. Certain assumptions have had to be made to do this , and these and the analysis are shown in Appendix 3C

Such preliminary cost estimates indicate that the envisaged micro unit could be established at a capital cost of $6715CAD. Assuming that an output of 60 tons of fertiliser was attainable in any year, production costs are projected at under $230CAD/ton. In turn such indicates that if resultant fertiliser was sold locally for $300/ton, such a price would represent a discount of at least 25% to the farmer, and could provide the micro entrepreneur with an annual net income of $4400CAD p.a. and a return on capital invested of 57% (before financial charges).

In turn, one micro unit could theoretically provide sufficient fertiliser for 375ha. of maize (assuming 160kg. per ha.) which could equate to the fertiliser requirements of 150 neighbouring rural families.

3.8 POTENTIAL NATIONAL BENEFIT (AND POTENTIAL PROJECT IMPACT).

Less than half of the 1.132 m. communal area smallholders in Zimbabwe use any fertiliser at all (Central Statistical Office: 1993/94). If it was assumed that such households had adequate access to fertiliser (which is certainly not the situation, but the assumption is made in the interests of conservatism) at least 0.5 m. smallholders have no access to inorganic fertiliser. In turn, such a conservative estimate would indicate that at least 700000 ha. of annually cropped land (mainly maize) does not receive fertiliser.

Making the further assumption that the average net yield increase response to an average application of 160kg of phosphate per ha. could be as high as an extra ton of maize per ha., national potential benefit of the envisaged strategy could equate to a further 700000 tons of maize output (which in turn would provide grain for 2.5 m. people). The gross value of such potential expanded output would equate to some $122.5 m.CAD.

The amount of fertiliser required for such a national potential would be some 112000 tons that theoretically could be produced by 1800 micro producers.

3.9 MAJOR FINDINGS AND LESSONS

The following findings of this assessment study are highlighted to protect IDRC investment in this specific research project; to only identify project components that might be suitable for IDRC public information programmes, or to highlight lessons that can be learned to enhance future IDRC funding of similar projects.

3.9.1 Significant Impact Potential

Assuming that eventual research results will be conclusive, this project displays very significant impact potential. Mention is made in the report that such impact could represent increased cropping output of more than $120m.CAD. If even 20% of potential was realised, it is possible that the Project outcomes could include sufficient increased food production for 0.5 m. people. In addition, the Project could impact substantially on the need to create economic opportunities within Zimbabwe. The magnitude of such a major potential impact is such that it not only falls squarely into a possible strategy to implement official Zimbabwean policy, but it would represent a unique achievement in terms of international development research. Above all though, because of the increasing frailty of long term sub-Saharan food security, the IDRC has a public duty to continue to champion this project topic and promote its implementation.

3.9.2 Need for a Commercial Feasibility Study

The assessment report highlights the need for a full and complete study be conducted into the feasibility of the emergent strategy for the commercialisation of this Project. With resultant more definitive answers than can be given now, the IDRC could then call a conference of relevant or potentially relevant stakeholders to create awareness of this Project's potential (such a conference could also be an effective public relations exercise on its own). Policies and strategies for the subsequent implementation phase could then be jointly planned, and all relevant parties could take ownership of their possible role in an implementation phase.

3.9.3 Research - Driven by Market Mechanism or Technology?

The absence of even preliminary financial and marketing appraisals within the Project programme is of concern, as the market mechanism is always the final determinant as to whether or not research findings will be finally implemented. In the case of this Project, it has been largely fortuitous that its potential implementation displays broad economic feasibility. The development of a "business plan" should be a cardinal departure point for any

development project - in order to plot and guide project planning as well as resource allocation. Such a "business plan" could always be updated during the project process as more detailed information becomes available during the course of the project.. In the absence of a more commercialised project orientation, any research process will tend to be driven by specialists and their specific technological interests.

Researchers tend to design projects around technical questions. What is required in agricultural development research is for far more account to be taken of the of the social, economic and physical environments within which farming takes place. It also requires a new paradigm wherein the researcher, the extension worker and the farmer work together in a more holistic arrangement, rather than the researcher being ultimately concerned with technology transfer. The researcher in particular must understand and be guided by the true needs, attitudes and resource availability of his/her target beneficiaries. Again it was fortuitous (due to the enthusiasm and sensitivity of the senior research personnel) that this Project moved closer to the community and learned of its socio-cultural values and farming systems.....if it had not done so, the real potential value of the research might have been stillborn.

3.9.4 Function Before Form

Thorough project preparation, including the development of a business plan (even if such a plan had to be refined during Project life), would crystallise strategic approach and functional profile. It is only after such a procedure has been completed that a project's specific human resource requirements can be identified. Failure to adhere to this sequence can weaken local project teams.

3.10 APPENDICES

The following Appendices relating to this Project are attached to this section of the report:

Appendix 3A

Phosphate Rock Blends: Publications Referred To and List of Contacts Made

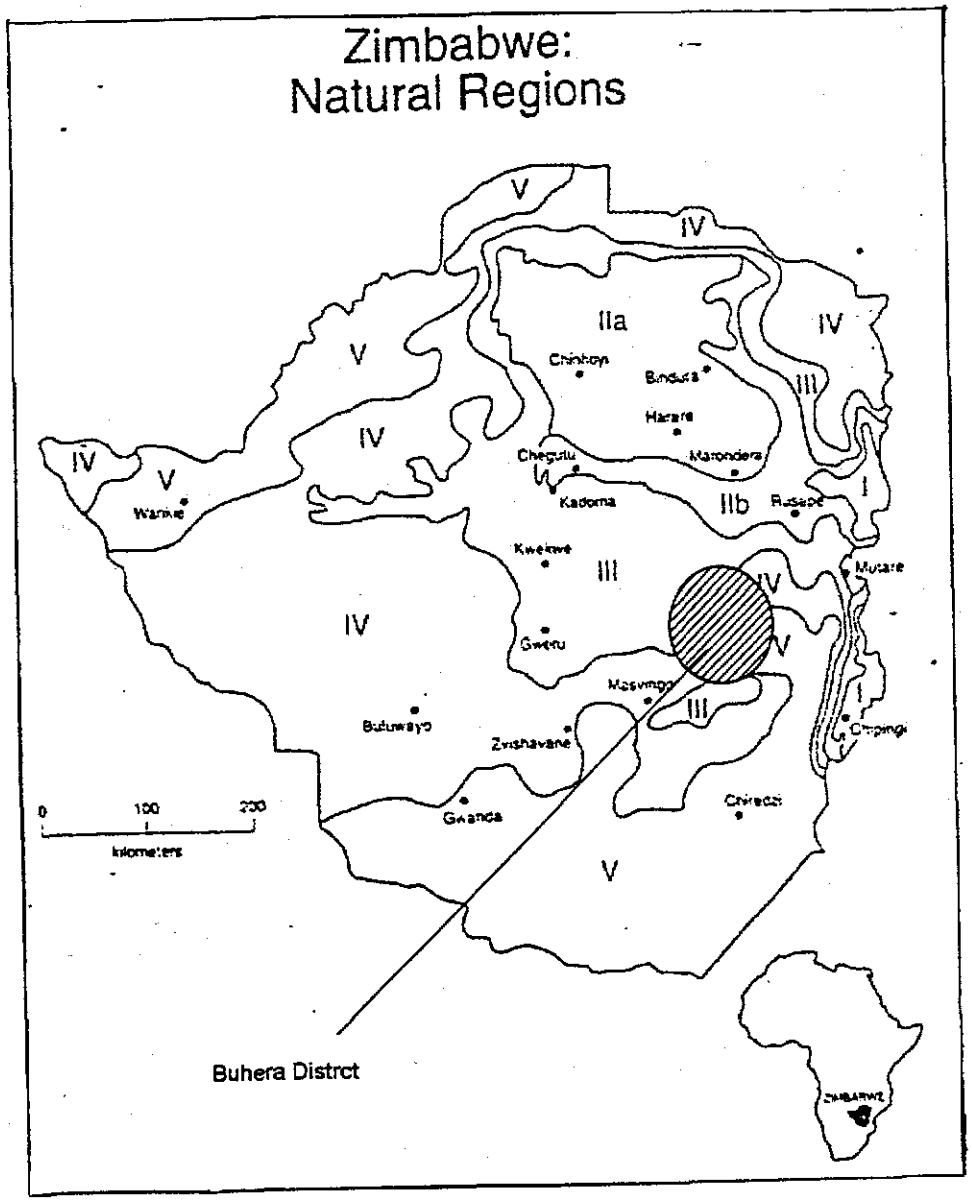
1) Publications Referred To

a) *CENTRAL STATISTICAL OFFICE, ZIMBABWE.* December, 1996. "Agricultural and Livestock Survey in Communal Lands 1993/94".
b) *CENTRAL STATISTICAL OFFICE, ZIMBABWE.* February, 1996. "Agricultural Production on Small-scale Commercial Farms 1994."
c) *CENTRAL STATISTICAL OFFICE, ZIMBABWE.* October 1993."Crop Production on Large Scale Commercial Farms 1992."
d) *CENTRAL STATISTICAL OFFICE, ZIMBABWE.* April 1997. "Prices".
e) *E.E.WHINGWIRI, K.MASHINGAIDZE, M.RUKUNI.* 1992. "Small-scale Agriculture in Zimbabwe".
f) *ECONOMICS DIVISION, MINISTRY OF AGRICULTURE, ZIMBABWE.* March 1997. "The Agricultural Sector of Zimbabwe". Statistical Bulletin.
g) Edited by *MAIA CHENAUX-REPOND; Published by FRIEDRICH-EBERT-STIFTUNG.* July 1996. "Women Farmers' Position; Our Response to the Report of the Land Tenure Commissiom".
h) *H.JOHNSEN, R.FERNANDES, L.MUKURUMBIRA, C.SUKUME, J.RUSIKE.* February 1997. "Phosphate Rock Initiative: Country Case Study for Zimbabwe". Draft Report for The World Bank.
i) *IDRC PROJECT SUMMARY.* 19/6/92. "Phosphate Rock Blends: Dev. Local Alternatives/Zimbabwe".
j) *IDRC SUPPLEMENTAL PROJECT SUMMARY.* March 1996. "Phosphate Rock Blends: Developing Local Alternatives (Zimbabwe)."
k) *M.S.KACHERE* (Business Development Manager, Chemplex Corporation). May 1995. "Agricultural Inputs Policy: The Case for Fertilisers."
l) *T.R.C.FERNANDES AND P.VAN STRAATEN.* November 1995. "Compacted Phosphate Blends from Dorowa Rock Phosphate, Zimbabwe". Third Interim Report.
m) *T.TAKAVARASHA* (Deputy Secretary, Ministry of Lands, Agriculture and Water Development, Zimbabwe). 1995. "Small-holder Agricultural Development in Zimbabwe with Particular Reference to the Fertiliser Industry". FSSA Journal.
n) *ZIMBABWE GOVERNMENT.* "Zimbabwe's Agricultural Policy Framework: 1995-2020".

2). Contacts Made.

Dr J.Rusike (Senior Lecturer, Dept. of Agricultural Economics and Extension, University of Zimbabwe).
Dr P.van Straaten (Adjunct Professor, Dept. of Land Resource Science, University of Guelph).
Dr S.C. Muchena (Managing Director, African Centre for Fertiliser Development).
Mr J.Able (Omnia Fertilisers).
Mr T.R.C.Fernandes (Chairman and Senior Mineralogist, Institute of Mining Research, University of Zimbabwe).
The Librarian, Ministry of Agriculture.
The Librarian, Women's Bureau of Zimbabwe.
The Publications Officer, Central Statistical Office.

Appendix 3B


Zimbabwe:
Natural Regions
I
IIa
IIb
III
IV
V
Chinhoyi
Bindura
Harare
Marondera
Chegutu
Kadoma
Rusape
Kwekwe
Gweru
Masvingo
Mutare
Chipinge
Bulawayo
Zvishavane
Gwanda
Chiredzi
Buhera District
0
100
200
kilometers

Appendix 3C

Estimated Capital Cost, and Possible Income and Expenditure of Operating a Micro Fertiliser-blending Enterprise

	$ CAD
1. *ESTIMATED CAPITAL COSTS* (Zim $8.1 = $1 CAD)	
Mixing/pelletising unit (IMR received a Zim $ 87000 quote for the manufacture of a once-off unit. It is probable that that cost could be substantially reduced with a simpler design and manufacture on scale).	5000
Honda 4.1 kw petrol engine	820
2 wheelbarrows	200
2 spades	35
5m² Sheltered area	60
5m² Store	600
TOTAL CAPITAL COST	6715
2. *ESTIMATED ANNUAL OPERATING COSTS*	
Raw materials	
30 tons phosphate rock material @ $101.80 CAD	3054
30 tons superphosphate fertiliser @ $290.25 CAD	8708
Fuel (0.5l/hr @ $0.65 CAD per litre for 1800hrs. per year)	585
Transport (60 tons of raw material over 100km @ $0.06 CAD per ton kilometer).	360
Packaging ($0.10 CAD/25kg)	240
Repairs and maintenance	
Mixer/pelletiser (10% of capital cost over life period)	25
Engine (20% of purchase price over life period)	41
Depreciation	
Mixer/pelletiser (over 20 years)	250
Engine (over 4 years)	205
Buildings (over 20 years)	33
Smalltools (over 3 years)	78
TOTAL ANNUAL OPERATING EXPENDITURE	13579
3. *ESTIMATED PRODUCTION COST PER TON*((Before financial charges) = $ 226.32 CAD /ton.	

4. *PROJECTED PROFITABILITY*

The current price for phosphate fertiliser in Zimbabwe is $ 290.25 CAD per ton f.o.r. Harare (super phosphate). However it is reported that communal area small farmers can be asked to pay up to nearly double this price in some areas and such a high price mark-up reflects a lengthy supply chain and the logistical difficulties small farmers invariably have to contend with regarding access to fertiliser supply. If it is assumed that the communal area farmer has to pay an average of $400 CAD per ton (37% mark-up on Harare prices) then a micro fertiliser-blending enterprise could charge up to $300 CAD and provide small farmers with fertiliser at a probable discount of at least 25%.

If the micro enterpreneur charged the same price as that of commercial fertiliser f.o.r. Harare ($290.25 CAD), his net margin would represent a return on capital of 57% (*before finance charges*) and would amount to some $ 3835 CAD p.a. . In turn, his output of 60 tons of fertiliser per year could provide fertiliser for 375 ha @ 160 kg per ha or easier physical access to fertiliser (at a discounted price of some 30%) for up to 150 farm households within the immediate vicinity.

Appendix 3D

Fertiliser Production in Africa

Country	Ranking	Nutrients(t/yr)
Morocco	1	1416000
Egypt	2	991800
Tunisia	3	840500
South Africa	4	764000
Nigeria	5	288900
Mauritius	6	172500
Algeria	7	127700
Zimbabwe	8	107800
Zambia	9	4700
Tanzania	10	4300

Source: Fertiliser in Africa IDRC 1993

Fertiliser Market Share by Distribution Type

Agency	YEAR			
	1985	1990	1993	1995
Co-operatives	52	15	4	1
AFC Lending Groups	21	13	14	14
Traders	12	29	30	35
Manufacturers	15	43	52	50
TOTAL (%)	100	100	100	100

Source: Windmill (Pvt) Ltd

Appendix 3E

Pertinent Features of the Zimbabwean Agricultural Sector

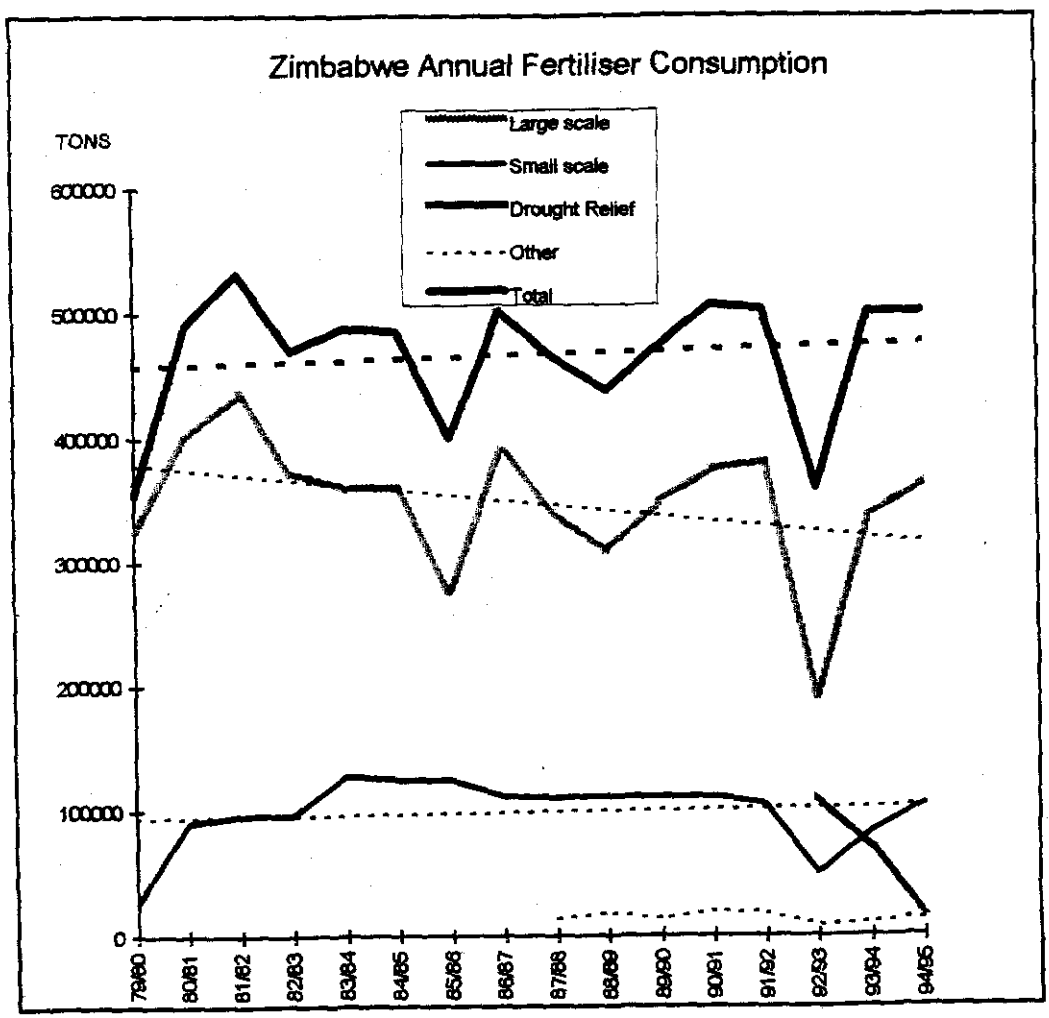
	Small-Scale			Large-Scale	
	Communal Areas	Resettlement Areas	Commercial Farmers	Commercial Farms	Government Farms
Estimated population ('000)	5327	421	166	1160	38
No. of Farms	1000000	56794	8500	4832	55
% Distribution	93.4	5.3	0.8	0.5	0.0
Total area (million ha)	16.34	3.29	1.38	10.74	0.42
% Distribution	50.8	10.2	4.3	33.4	1.3
% of land in :					
Natural Regions I & II	9	19	19	35	4
Natural Region III	17	38	35	22	32
Natural Regions IV & V	74	43	46	43	64
Average farm size (ha)	18	58	162	2223	7644
Cropping intensity (%)	14.0	5.8	4.3	4.2	2.3
Average area cropped (ha)	2.5	3.4	7.0	93.4	175.8
Cropping patterns (area %)					
Maize	51	54	55	39	n/a
Millet	15	6	4	<1	n/a
Cotton	8	11	11	7	n/a
Groundnuts	9	11	12	<1	n/a
Tobacco	<1	1	<1	18	n/a
Sorghum	8	3	1	2	n/a
Wheat	<1	<1	<1	9	n/a

Source: Extracted from GOZ "Zimbabwe's Agricultural Policy Framework: 1995-2020"

Appendix 3F

Zimbabwe Fertiliser Consumption by Sector (Tons)

Year	Large scale	Small scale	Drought Relief	Other	Total
79/80	327779	27113			354892
80/81	400620	90260			490880
81/82	436240	95969			532209
82/83	373298	97211			470509
83/84	361435	127688			489123
84/85	361435	124399			485834
85/86	276013	124147			400160
86/87	390495	111290			501785
87/88	340954	109751		13400	464105
88/89	308857	110953		18480	438290
89/90	349362	110860		13965	473987
90/91	375571	110953		20000	506524
91/92	380974	104186		18203	503363
92/93	191376	49732	110800	8455	360363
93/94	337995	83806	68895	10784	501480
94/95	385090	104740	18590	13298	501718



SOURCE: Extracted from a May 1995 Chemplex Corporation Ltd. submission paper for formulation of GOZ agricultural inputs policy : "The Case for Fertilisers" (M.S.Kachere).

4.0 GRAIN DEHULLING (MALAWI) - PHASES I & II (85-0223 & NO.90-0267)

4.1 BACKGROUND TO THE PROJECT

Most rural residents of Malawi dehull maize at home through the use of traditional pestle and mortar methods. It is then ground into maize meal (either using a similar method or by using hammermill operations).The domestic pounding of sorghum is reportedly even more laborious than that of maize, suggesting a reason why there is a resistance to sorghum production in the more sorghum-suited drier areas.

The purpose of the first phase of this Project was to develop a plan to introduce appropriate grain dehulling technology into the country's rural areas. Researchers were to test 4 grain dehullers that had been developed under other IDRC African programmes. Research was to have been conducted within typical Malawi village conditions in both maize and sorghum growing areas. Researchers were also to evaluate the performance of these new dehullers against that of Engleberg dehullers (essentially a rice dehuller but fairly widely used in Malawi as a maize dehuller) in 2 maize-growing areas. The Project called for the development of skills for local management of the processing machinery, and for the identification of potential local dehuller manufacturing capacity.

The subsequent second phase of the Project was to closely examine the impact of the 4 pilot mills installed during the first phase. The experimental introduction of dehullers to the Northern Region was to be extended, and the techniques of dehuller introduction were to be refined and improved.

Research for the Project was conducted by the Farm Machinery Unit of the Malawi Ministry of Agriculture's Chitedze Research Station, in conjunction with necessary support from the MOA's extension services and relevant private sector farm machinery manufacturing capacity within the country.

IDRC funds allocated to the Project amounted to $ 166000 CAD for the 1st Phase, and a further $159500 CAD in respect of the Project's 2nd Phase. The 1st Phase of the Project ran from November 1987 to April 1991; the 2nd Phase operated from 1991 for a further 3 year period.

4.1 PROJECT OBJECTIVES (AND EXPECTED OUTPUTS).

The general goal of the overall Project was to develop a strategy for the "dissemination" of grain dehullers in rural Malawi. Consideration should be given to the capacity for implementation of improved processing of maize and sorghum.

4.1.2 Phase I Objectives

The specific objectives of the Project's 1st phase were:

a) to test 4 dehullers (2 RIIC and 2 smaller versions) under maize and sorghum growing areas;

b) to evaluate the performance of existing Engleberg dehullers in two maize growing areas;

c) to develop Malawi resource skills in rural grain processing systems;

d) to identify local manufacturing skills for dehuller production; and

e) to develop a national strategy for delivering appropriate dehulling technologies to rural Malawi.

The main output of Phase I was to have been a national strategy for wide-scale introduction of dehulling technology in Malawi. Such strategic formulation was to have been facilitated by data from the integration of dehullers into the sorghum and maize rural food processing systems. This data was to be provided by 4 existing hammermill operators who had received dehullers under the Project. In addition, it was envisaged that 5 Malawi researchers would develop capabilities to implement or direct a national dehulling programme.

The ultimate direct beneficiaries of the Project were seen to be rural families who would rely on dehullers to relieve them of the daily home pounding of their grain.

4.1.2 Phase II Objectives

The 2nd phase objectives were:

a) to assess the impact of abrasive dehullers on the four rural communities targeted under phase I;

b) to refine potential dehuller techniques through 4 additional experimental installations in the Northern Region;

c) to identify critical requirements of a self sustaining system for providing small-scale dehullers in the rural areas;

d) to formulate a package for wider scale popularisation of dehullers; and

e) to identify critical areas for further research and policy attention.

Outputs from this second phase were to include improved knowledge about the level of effective demand for mechanical dehullers; a dissemination plan prepared jointly with policy and extension agencies; clarification of the assistance that a dehulling service might provide for rural households; the extent of a possible benefit through a greater acceptability of grain hybrids; knowledge of the economics of operating dry abrasive dehullers; and an increase in the cereals processing research capacity of the country.

4.2 PROJECT OUTPUTS

Despite prior communication difficulties with Malawi (and particularly Chitedze) and the fact that Project personnel had not been briefed by the IDRC prior to the assessment visit, the relevant research personnel were very willing to assist in the provision of appropriate data.

Significant eventual project outputs were identified as follows:

4.2.1 Evaluation of Dehulling Methodologies.

The Project adequately proved that abrasive dehulling was more efficient than that of the more common Engleberg method. Additionally, abrasive dehulling caused far less breakage of hybrid seed than did the traditional pestle and mortar method.

The report did not indicate one important factor. Results showed that, regarding local varieties of maize, handpounding produced a lower grain breakage level than either mechanical method. Appendix 4D shows the percentage of breakages (grain particles of <5.8mm) for different grain varieties and using different dehulling methods. With the smallholder sector planting over 90% of its maize to non-hybrid varieties, one would nor expect a prevailing dehulling system to change quickly. Development intervention on the grounds of easing rural labour burden might seem attractive to developers. However, rural inhabitants would have their own, and possibly different, set of prioritised needs. As an example, food security (in this instance represented by lower breakages) would probably be considered more important than the easing of the labour burden. An easier method of dehulling would take a long time to be accepted under such circumstances, particularly if already very scarce cash resources of rural households had to be stretched further to pay for an "outside" dehulling service.

It is vitally important that the relevant and prioritised needs of recipient beneficiaries be acknowledged and taken into account when appraising different technologies. Appraisal based only on technical factors is insufficient.

4.2.2 Greater Knowledge of Cereal Processing Systems

Notwithstanding a number of imperfections and questionable directions (as discussed in this report), the Project has made a significant contribution to the understanding of existing and potential cereal processing in Malawi (mainly maize). Such knowledge should be beneficial to the country as, due to increasing demographic pressures on a very scarce land resource, Malawi has to actively pursue strategies to increase food output.

However, despite the Project's objectives, some critical knowledge gaps still exist, such as the economics of dehuller operation, and the market potential for the technology. The Consultant has given a preliminary estimate of costs of setting up and operating such dehulling services (see Appendix 4E). It seems probable that (even at low throughput levels) dehulling can be profitable and indeed provide an exciting rural entrepreneurial opportunity area.

Market potential is more difficult to gauge. Theoretically, based on the the food requirement levels of some 7m. people living in the smallholder sector, there could be a potential need for more than 2500 dehullers (if each dehuller operated at a 800 ton capacity). Affordability of dehulling services is however another factor, and it might be that only 10-20% of households could pay for such services.

The Consultant tried to obtain the number of Engleberg units sold in Malawi over the last 10 years from the agent company (Brown and Clapperton, Lilongwe). For reasons of commercial confidentiality, this was not forthcoming. Most existing dehullers operate only in areas along the national electrical grid, and adjacent to better roads. It is estimated that between 100 and 200 units are probably in operation. Such would indicate a potential abrasive dehuller market of between 150 and 300 units (which would only serve the grain dehulling needs of between 6% and 12% of the smallholder sector).

4.2.3 Development of a National Strategy for Dehuller Introduction

This expected output and main Project objective did not materialise (despite being the main focus of the extended Phase II). This was possibly due to the unsuitable composition of the research project team (discussed later under Project Inputs). The issue is dismissed in 12 lines of the final project report, where recommendations were made that the implementation role should be handed to the Malawi Industrial Research and Technology Development Centre and other role-players. The Consultant visited the MIRTDC in Blantyre and was unconvinced of their stated capacity to handle such a task (e.g. this organisation is unable to source replacement grinding stones for the IDRC-introduced abrasive dehullers and the Consultant was even asked if he could help).

4.2.4 Greater Community Acceptance of Hybrid Grains

A strong Project motivation (see Project Summary papers) was a pre-project hypothesis that if rural small scale abrasive dehulling technology was widely introduced in Malawi, it would encourage greater usage of higher-yielding hybrid seeds,

The reported higher grain breakage factor that is experienced from hand pounding of thinner-hulled hybrid grains compared to local thicker-hulled varieties is an apparent real perception (see Appendix 4C). A 1991 Rockefeller Foundation/MOA survey indeed showed that such a factor received 3rd highest mention amongst reasons why smallholders do not use hybrid seed (other important reasons were lack of credit, cost of seed and the poor storage characteristics of hybrid grain).

An essential part of the Dehulling Project was a consumer survey to gain reaction from the Project's introduced dehulling services. Unfortunately the consumer survey is no longer available and therefore assessment was impossible. However, the final Project Report mentions that 90% of women interviewed were appreciative of the dehulling service. It should be pointed out that the survey was carried out amongst users of the service who might not have been a representative cross-section of the local communities.

4.2.5 Other Significant Outputs

Additional Project outputs were identified as follows:

a) The Project leader went on a one-year training course (at M.Sc. level) to the U. of Newcastle-Upon-Tyne.

b) Farm Machinery Officers were sent to Botswana and Zimbabwe for 3 weeks of familiarisation and training regarding management aspects of RIIC and ENDA types of dehullers.

c) Malawi manufacturing capacity to produce dehullers locally was identified (but was not developed further and a national strategy to introduce dehullers did not evolve).

d) The Project process revealed the need and method of making improved modifications to all types of mechanical dehullers operating within Malawi.

e) Dehullers were exhibited at a number of public gatherings and shows.

f) Papers on grain dehulling were presented at the Regional Grain Processing Conference in Dakar in 1989.

g) Related papers have been presented at national conferences in Malawi.

h) A further paper was presented at the Agricultural Engineering Conference in Arusha in1996.

4.3 PROJECT INPUT AND CONTEXTUAL FACTORS

An overall disappointing output performance of the Project can be attributable to a number of input and contextual factors that have been identified below:

4.3.1 Contextual Factors

Agricultural is of strategic importance to the Malawi economy. Over 80% of the Malawi population living in rural areas derive their livelihood from farming, either directly or indirectly. Poverty in rural areas and in the agricultural sector pervades amongst the smallholders. Amongst smallholders, 56% of households have been estimated by the UN to be living beneath the poverty line. Such households have been relatively unaffected by development intervention programmes over the last decade or so, mainly because it is easier to deliver increased support to farmers with larger land holdings and more resources.

The smallholder sub-sector is based on traditional land tenure systems and is mainly subsistence oriented. It comprises of some 1.6 m. households farming 1.8 m. ha., and 56 % of such households cultivate less than 1 ha. and a further 31% between 1-2 ha. . Of the 87% of smallholders who farm less than 2 ha., the production of local low-yielding varieties of maize dominates cropping systems (see Appendix 4B for an analysis of cropping patterns).

Women play a key role in this sub-sector. They are amongst the poorest households both in terms of asset ownership and access to resources and services. Women's work in agriculture is extensive and diverse involving them in planting, weeding, harvesting, processing, storage, preparation, marketing and care of livestock. One of the major work pressure times that a female head of household has to face is the advent of the onset of rains, when child illnesses become common, and when labour is urgently required on the farm.

However, while a strong case exists for the promotion of labour-saving technologies for women, development intervention has to be appropriate and specifically targeted to priority areas. Basic questions need to be asked in respect of this project. For example, while there undoubtedly would be many households that would sponsor dehulling services, would the vast bulk of Malawi smallholders be able to afford the service? The going rate for dehulling charges ranges MK3.50 to MK 6.00 per 18 kg. of maize. This means that maize for an average family's consumption for a year (some 1.3 tons) would cost at least MK260 to dehull. In turn, such a cash outlay would represent a minimum of 20% of average smallholder household income (the NSSA 1993 reported that average rural household income for various districts ranged from MK180-610 per adult equivalent per annum). Freeing up the labour load is well and good...but some source of extra cash inflow must be introduced to pay for the time-liberating new service.

A further factor related to the context of the Project was the issue of Malawi Government food aid to people (refugee and disaster victims) in the vicinity of some dehuller sites. Food aid included the issue of maize meal and this free food may have decreased the apparent demand for dehuller services. Factors that also may have influenced apparent demand for dehuller services included a suspicion on the part of operators (due to the fact that Project Staff were Government officials) that they might have been taxed on earnings. They may therefore have deliberately under-recorded sales.

4.3.2 Technological origin and impetus of the research project

This research project maintained a largely technological momentum, probably due to its IDRC technological and policy origins. For the IDRC, it represented "a further development of the network of dehulling and village service milling projects being aggressively pursued by Post Production Systems in East and West Africa" (see IDRC Project Summary). It also linked up with other IDRC Project-developed RIIC and ENDA machinery (Botswana and Zimbabwe). Furthermore, some of the assessed Project's strategy (such as the choice of dehulling sites and mill operators) was implemented on the basis of where the technology would have the chance of succeeding (see page 8 of the "Final Report /Abrasive Grain Dehuller Evaluation in Malawi"). For development to be effective (rather than efficient) support has to be targeted to where rural community needs are the greatest.

The potential dangers of such an "efficient approach" (as opposed to an "effective approach") are that an agricultural research product might not be appropriate to most farmer needs and requirements. Nor may it be relevant to prevailing smallholder farming systems, or indeed be affordable to the vast bulk of rural households. The question has to be asked as to whether or not the Project actually fell into the development trap of delivering assistance to where it was deliverable, rather than where it was needed.

A far more holistic approach is required and a thorough knowledge of the socio-economic needs and values is needed as a departure point to any composite strategy to change farming systems. For example, there are other

reasons than dehulling characteristics for non-usage of hybrid seed, including cost of seed, no access to credit, poor storage qualities and non-availability (see Appendix 4C). Such a multiplicity of factors influencing the usage of hybrid seed reveal the futility of addressing merely one factor in isolation of the others, and trusting that it alone would change the situation.

The on-farm storage of grains is an important example because invariably food runs out a couple of months before the next harvest. A perception that hybrids do not store well because of thinner husks is very important to a society that still makes use of efficient traditional storage systems such as *nkhokwe* (a traditional grain storage method using clay-caulked and sealed baskets). Easier dehulling is of little importance if maize, in either seed or flour form, cannot be stored as safely as the thicker coated (and therefore more insect-proof) local grain can.

Even a preliminary socio-economic survey should have been the departure point for the programme. Such would have provided both a market and a smallfarmer needs orientation for the strategic planning of both the research programme and the implementation of its results. Such a pre-project approach would have guided strategy, and consequently helped to include more appropriate members of the local project team.

4.3.3 Institutional Partnership and Capacity

Linked to the comments made in 4.3.2 regarding the need for more Project socio-economic sensitivity, is the observation that the Project team was virtually made up of technical researchers. Notwithstanding the obvious enthusiasm and abilities of the Farm Machinery Unit, the inclusion of a strong development socio-economics functionary within the team would have guided Project directions and strategy, and more thorough project planning should have taken this into account.

There was a further obvious Project need for an agribusiness specialist to have been included within the research team. This is evidenced by the absence of costing and market information within project outputs (one of the main objectives of the Project was to formulate a national implementation plan for the introduction of dehullers on scale and this objective was not achieved).

An Economist from the Dept. of Agricultural Research sat on the Project Steering Committee, but this Committee only sat once a year to review progress and provide advice on the running of the Project.

An additional institutional-related input was the sponsored visit of four officials to Botswana and Zimbabwe. The visit was made at the beginning of the Project, and was solely for the purposes of technical exposure and training (again highlighting the technology-driven character of the Project). The point was made to the Consultant by the Researchers that it would have been more effective if that visit had been a shorter one, supplemented with a later follow-up visit after the Researchers had gained experience under Malawi conditions. The Researchers feel

somewhat isolated, particularly due to Malawi's communication problems with other countries, and now have a need to discuss (technical) aspects of their experience with other dehuller personnel.

4.3.4 Financing Mechanism and Procedure

A serious problem arose during the Project regarding researcher access to Project funding. This was due to IDRC Project funds going into a central Government account and, what with bureaucratic and administrative problems, it took the Project up to a year to gain access to funds. Researchers reported that such delays in funding constrained fluidity and momentum of the Project.

4.4 PROJECT REACH AND IMPACT

Apart from the relatively narrow reach of the agricultural engineering sector, and those rural households who had or still have access to Project dehulling services, Project reach and impact are inert. Potential impact is in danger of disappearing altogether if the technology remains unexploited.

The Project however has significant potential impact as one of a number of agents and influences that, taken holistically, could be used to convert a higher proportion of Malawi smallholders to hybrid maize production. The potential benefit of such a strategy, in terms of increasing food security, is very significant. This factor is illustrated by the following calculations:

MALAWI: POTENTIAL IMPACT OF SMALLHOLDER SECTOR CHANGING TO HYBRID SEED AND ABRASIVE DEHULLING	
Existing Situation	*Potential Situation*
1.15 m. ha. non-hybrid maize grown @ av. yield of 0.8 tons/ha. = 920000 tons	1.15 m. ha. hybrid maize grown @ av. yield of 1.5 tons/ha. = 1725000 tons
If this is dehulled manually, breakages will be 12.5%.	If this is dehulled by abrasive dehullers,breakages will be 4.4%.
Therefore the amount of residual grain for milling ("mphale") will be 87.5% of 920000 tons = 805000tons .	Therefore the amount of residual grain for milling ("mphale") will be 95.6% of 1725000 tons = 1649100tons .

The potential impact of the Project is (if issues such as accessibility, affordability, socio-cultural acceptability, extension, credit, and grain storage could be addressed) to increase Malawi smallholder food output by over 100% or a further 850000 tons annually. Such possible increased output would provide sufficient grain for an equivalent of some 2.8 m. people or 640000 households. It would also represent an increase in smallholder farm output of $136 CAD million.

At a more micro level, the Project impact is dangerously close to becoming negative. With the ending of the Project funds, the Farm Machinery Unit largely resorts to the considerable enthusiasm of its officers to try and maintain some degree of momentum. Local research budgets have been trimmed further, and assets purchased under the Project need replacement or repair. More serious is the fact that the Project initially enhanced the position of the Farm Machinery Unit amongst the rural community, but now that community expectations of Project outcomes are not being met, Researchers claim that a reverse effect is starting to take place.

4.5 MAJOR FINDINGS AND LESSONS

Due to the magnitude of the potential impact that this Project could still have on one of the world's poorest countries, it is as well to highlight the major findings and lessons learnt:

4.5.1 Agricultural Research Must be Appropriate to Real Needs

An agricultural research product must be appropriate to most farmer needs and requirements, or to smallholder farming systems, or be affordable to the vast bulk of rural households. If it is not, there are dangers of it falling into the development trap of delivering intervention to where it was deliverable, rather than where it was needed. In particular, even technical research direction should be guided by broader market conditions if its results are going to have wide relevance. If such a research project originates from technological policy and is driven by technical factors, it is unlikely to be sustainable in the longer term.

4.5.2 The Need for More Complete Project Preparation

A socio-economic survey (if even of a preliminary nature) should be the departure point for projects of this type. Such a wider pre-project approach would have provided for better preliminary appraisal of likely project feasibility. A broader understanding of socio-cultural issues prior to project implementation is essential. Such an understanding would not only help to identify particular risk areas, but would guide strategy and contribute towards the development of a thorough business plan. Once strategy had been decided upon, an analysis of functions to be performed would have indicated a more appropriate profile of the local project team.

4.6 APPENDICES

Appendices relevant to this project are annexed to this section as follows:

APPENDIX 4A

GRAIN DEHULLING (MALAWI) : PUBLICATIONS REFERRED TO AND A LIST OF CONTACTS MADE

REFERENCES:

CODA AND PARTNERS. 1994. "Malawi Agriculture Sector Study. Vols. 1-6".

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UNITED NATIONS AND GOVERNMENT OF MALAWI. 1993." Malawi - Situational Analysis of Poverty".

PEOPLE CONTACTED:

Mr W.F.Kumwenda, Farm Machinery Unit, Chitedze Research Station.

Mr. E. Kunkwenzu, Farm Machinery Unit, Chitedze Research Station.

Mr Shawa, Sales Manager, Brown and Clapperton Pvt. Ltd., Lilongwe.

Various Personnel, Malawi Industrial Research and Technology Development Centre, Blantyre.

Dr A.Saka, Assistant Deputy Director, Agricultural Research and Technical Services.

Mr. E.Mitumbiri, Post-harvest Systems Research, Makoka Research Station, Machinga.

The Librarian, Min.of Agriculture, Lilongwe.

The Librarian, World Bank, Lilongwe.

The Librarian, Chitedze Research Station.

APPENDIX 4B

CROPPING PATTERNS OF THE MALAWI SMALLHOLDER SECTOR

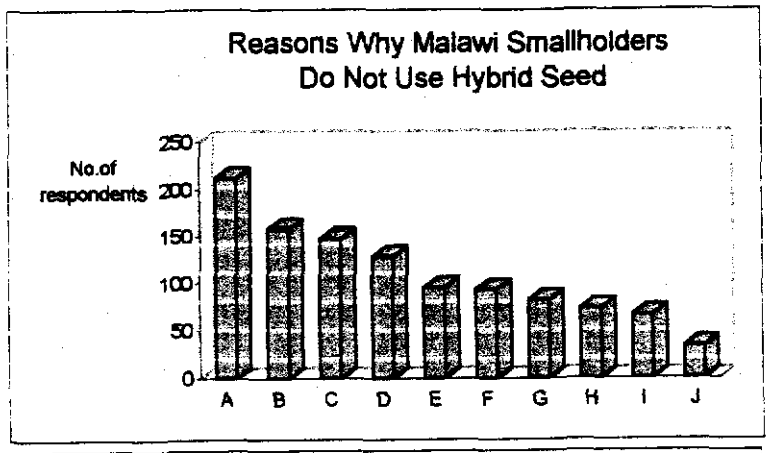
BY HOLDING SIZE (%)

Hybrid Maize	1.6	1.7	3.2	4.5	
Other Maize	80.3	76.9	70.7	63.5	
TOTAL MAIZE	81.9	78.6	73.9	68.0	
SORGHUM	0.3	0.7	0.6	0.4	
CASSAVA	6.2	3.1	2.1	1.8	
ALL FOOD CROPS	93.3	87.2	80.7	75.1	
ALL CASH CROPS	5.7	11.1	16.7	20.8	

Source: Annual Survey of Agriculture 1988

NOTE: 87% of Malawi's 1.6m. smallholder householders farm on landholdings of less than 2 ha.

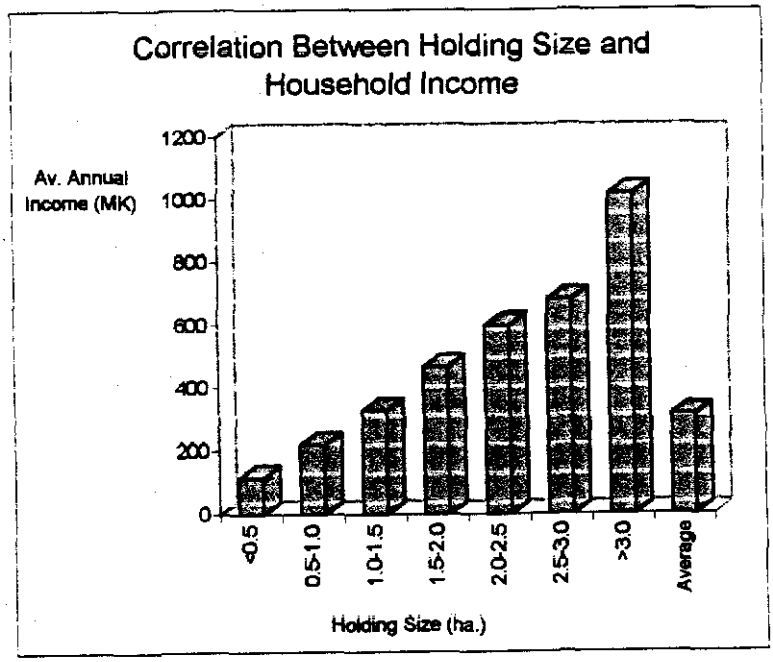
Appendix 4C



NOTES

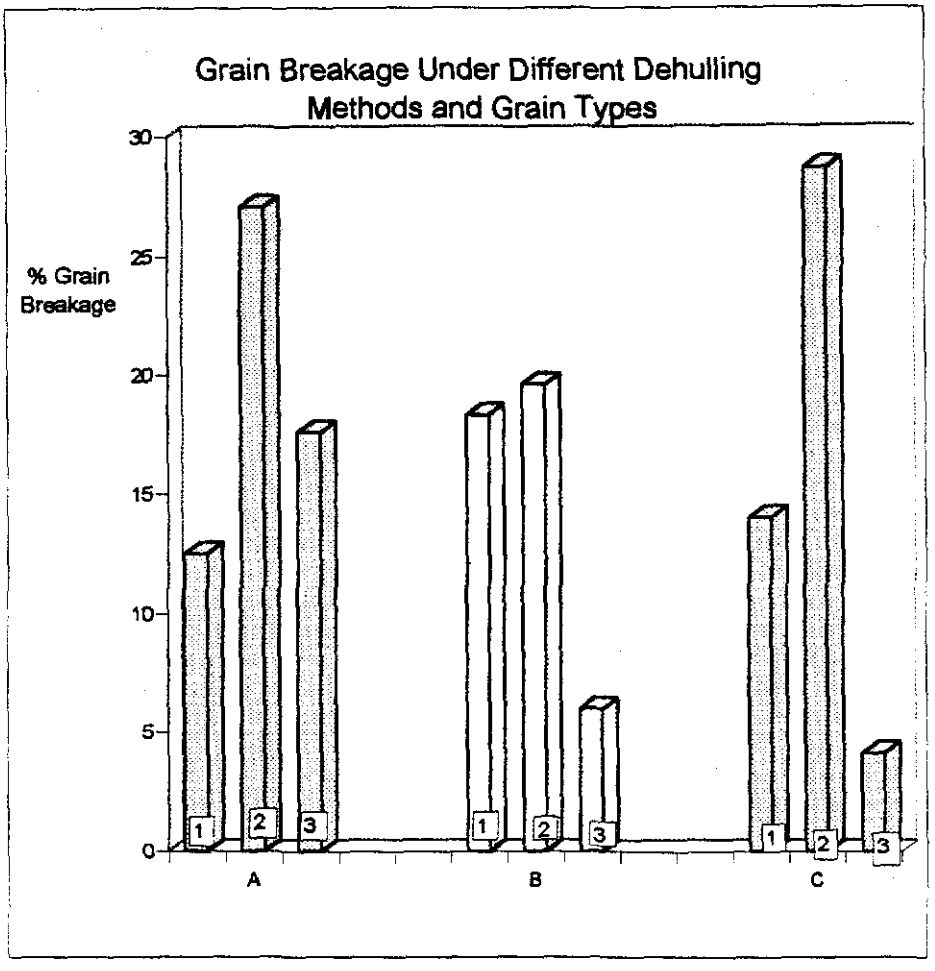
A = Cost of seed
B = No access to credit
C = Poor pounding characteristics
D = Poor storage characteristics
E = Other
F = Not available
G = Management constraint
H = More profitable cash crop
I = Labour constraint
J = Unsatisfactory yield

Source: Rockefeller Foundation/MOA Surveys 1991



Source : Annual Survey of Agriculture , MOA 1988

Appendix 4D



NOTES

DEHULLING METHOD
A = Traditional hand pounded
B = Engleberg dehuller
C = Abrasive dehuller

MAIZE TYPE
1 = Local variety
2 = R201 Hybrid
3 = NSCM 41 Hybrid

Source : Table 5.1,"Abrasive Grain Dehuller Evaluation in Malawi",W.F.Kumwenda, Farm Machinery Unit, Chitedze Research Station, MOA.

Appendix 4E

ESTIMATED CAPITAL COST AND INCOME AND EXPENDITURE OF OPERATING AN ABRASIVE DEHULLING ENTERPRISE

	$ CAD
1. *ESTIMATED CAPITAL COSTS* (MK10 = $1 CAD)	
1 Dehuller and electric motor	4800
5m² Milling shed	600
5m² Store	600
Installations	500
TOTAL CAPITAL COST	6500
2. *ESTIMATED ANNUAL OPERATING COSTS*	
Labour (based on MK800/month min.wage)	1000
Electricity (@ MK12ton)	980
Repairs and maintenance (7.5% of cost)	360
Depreciation	
Dehuller and motor (over 10 years)	480
Buildings (over 20 years)	60
Installation (over 10 years)	50
TOTAL ANNUAL OPERATING EXPENDITURE	2930
3. *ESTIMATED PRODUCTION COST PER TON* (Before financial charges)	
@ 100% capacity	3.20
@ 50% capacity	7.40
@ 30% capacity	11.96
4. *POTENTIAL REVENUE PER TON* (Before financial charges)	
@ MK 3.50 /18kg	19.44
@ MK 5.00 /18kg	27.78
@ MK 6.00 /18kg	33.33

NOTE:
The RIIC dehuller has a theoretical capacity of 818 tons p.a. (one shift of 8hr). Due to seasonal supply it is probable that throughput would be much lower. During the project, the Chalendewa unit achieved a throughput of 35% of capacity.

5.0 STARCH ADHESIVES (MALAWI) (IDRC PROJECT NO.92-1451)

5.1 BACKGROUND TO THE PROJECT

Malawi is a land-locked country with a large agriculturally based economy. In its small industrial sector, most industries serve the needs of the agricultural and food sectors. Industrial adhesives are used in large quantities for cardboard manufacturing, labelling of products, torch-type battery covers, book binding, etc. Cassava is one of the crops grown in Malawi - a crop known to contain starch chemicals that are useful in the formulation of adhesives.

This Project was therefore designed to develop industrial adhesive formulations from a cassava starch base. Such formulations could be used by Malawi companies who make their own adhesives on-site. A process for ready-made adhesives was also to be developed, the resultant product of which could be marketed to various industrial enterprises within the country.

Depending upon raw material types, and the intended end application, adhesives contain between 17% and 40% solids by mass, the balance being water or another solvent. The solids component is mostly made up of starch (at least 16% of total adhesive) which is chemically modified during processing. Other substances can be added to adjust the adhesive's stability or change its binding properties. The type of starch used also affects the final properties of the adhesive because of different initial chemical structures.

Starch adhesive formulations can be generally categorised into hot or fast-setting formulations (this involves a gelatinised process under high pressure and temperature), or cold-setting where the adhesives are used at room temperature. Hot-setting adhesives are used in large quantities where quick-setting is desirable (such as in the plywood industry), and are commonly prepared at the site of the user. Cold-setting adhesives are formulated away from the site of final use.

Funds of $ 244800 CAD were granted by the IDRC in 1993 for the execution of this collaborative 3-year Project between the University of Malawi and the Forintek Canada Corp. to develop formulations that could be used by the local Malawi industry. Such resultant formulations would be of both the hot and cold-setting types.

Extreme difficulties were experienced in prior communications with the Chancellor College-based research team. As a result the Consultant could make no prior arrangement for the meeting of relevant personnel in Zomba. This factor, the busy schedules of the Project Leader, and budgetary constraints all lead to a reduced fieldwork stage to this assessment. The result was a short period of interviewing which has affected range and extent of the assessment.

5.2 OBJECTIVES (AND EXPECTED OUTPUT) OF THE PROJECT

The goal of this research was to develop the technology necessary to initiate production of cassava starch-based adhesives in Malawi.

Specific objectives were:

a) to develop 10 adhesive formulations (3 hot-setting and 7 cold-setting) using starch from bitter cassava varieties as a raw material;

b) to demonstrate the technical and economic feasibility of production of adhesives through pilot operations; and

c) to disseminate the research results for utilisation by local industry.

Expected outputs of the Project included the 10 adhesive formulations; processes for the manufacturing of the developed formulations; and the commercialisation of the developed hot-setting adhesive formulations and cold-setting adhesive manufacturing processes. Wider by-products of the Project were to include a capability within Malawi for producing adhesive raw materials for both the local needs and the export market; reduction of foreign exchange expenditure on imported adhesives; creation of new income opportunities in rural areas; and the strengthening of University of Malawi research capability.

5.3 FINAL PROJECT OUTPUTS

5.3.1 Market Survey

A market survey was completed at an early stage in the Project life. This indicated that in 1991 95% of starch-based adhesives imported into Malawi were used in the manufacture of corrugated cardboard and torch-type battery cores. Total consumption of such adhesive types in Malawi in 1991 was 110 tons per year. The University is currently looking for more funds to explore other market potential in Malawi (it is considered that blockboard manufacture, textile sizing and other end uses of the adhesives might show increased market possibilities).

5.3.2 Adhesive Formulations

Progress has advanced in this area to a stage where all hot-setting formulations have been completed (including two that have been successfully tested). Cold-setting formulation work has been nearly completed but progress is hampered by lack of suitable laboratory plant for pilot tests.

5.3.3 *Waste Product Handling*

Laboratory studies have been completed on waste products (effluent, pulp and peel).

5.3.4 *Linkages and Research Capacity*

Research results have been disseminated at technology fairs and local and international conferences. There is no doubt that the University of Malawi (with assistance from Forintek) has become a known authority in this field.

5.4 PROJECT INPUT FACTORS

The following Project input factors have been identified by the Consultant as having had an influence (or potential influence) on the Project:

5.4.1 *Project Context*

This project was surprisingly approved by the Government of Malawi. The Project was seen to represent a priority area in that implementation of its results would lead to economic diversification, job creation, import substitution and possibly exports. It was also seen as a strategy to promote small-scale industries and stimulate agricultural production. Perhaps due to a crisis of expectations, this is probably a serious misperception. The setting up of an adhesives capacity would only create "5 or 6 jobs" in the envisaged starch extraction unit and a further "4 jobs" in the manufacture of cold-setting adhesives (the figures quoted are derived from the IDRC Project Summary and research personnel have no reason to amend these statistics). In addition the amount of foreign exchange such a project might save the country is probably no more than $480000 CAD p.a. (the Malawi starch-based adhesive market is not larger than 120 tons p.a. and a theoretical world price is in the region of $4 CAD/kg.).

Of even greater concern is the excessive emphasis in the IDRC Project Summary placed on the benefits that would accrue to small-scale cassava farmers. Starch represents 20% of cassava by mass, and a 16% content of starch based adhesives. The 120 ton/annum starch adhesive market in Malawi only requires an annual supply of 19.2 tons of starch material (equivalent to only 96 tons of cassava). A cassava raw material requirement of 96 tons p.a. could be obtained from no more than 160 ha. of cassava (or some 0.27% of national production). In addition, because of the water-intensive starch extraction process, the siting of such a project would be crucial and probably far from cassava production areas. The crop is bulky to transport and therefore transport costs would probably erode any possible benefit a handful of cassava growers might derive from supplying the potential commercial project.

In the same context, some statements made, and statistics used, in the IDRC Project Summary are completely erroneous (and potentially very embarrassing for the IDRC). "The most abundant and under-utilised starch-rich crop in Malawi is cassava" and "it is produced over more than 500000 ha. which represents an annual harvest of more than 10 million tons" are representative of such statements.

The smallholder area planted to cassava in Malawi is only 3.2% of that planted out to maize (see Appendix B). Cassava is mainly grown in the more humid areas of the country, mainly along the Lakeshore, Zomba district, the Shire Highlands and in areas in the North. When the first NSSA was carried out in 1968/69, cassava production was estimated to be around 300000ha. However, due mainly to the spread of Cassava Mosaic Virus and bacterial blight, national area planted has fallen to below 35000ha. during some seasons during the 1980's. By the early 1990's, NSSA statistics indicate a probable stabilisation around the 60000 ha. level (probably due to disease-free planting material being made available from Chitedze Research Station). National cassava average yields are in the region of 700 kg/ha.

While commercial agribusiness projects are important to Malawi, equally important is that their potential to contribute to economic development should be placed in the correct context. Development support availabilty is a scarce resource relative to the needs of Malawi. Such assistance should be allocated and used to the optimum.

5.4.2 *Technological impetus of the research project*

Ever since this project was initiated by the University of Malawi (originally it was to have been a silicate adhesive project) the project has been technology-driven. At the same time, excessive claims were made as to how much benefit potential there was for small-scale farmer suppliers, and for new economic development associated with the Project.

5.4.3 *Project Preparation*

A preliminary feasibility study should have been the departure point for the project's preparation, i.e. to provide an initial appraisal of commercial *and* development potential of the project, as well as a preliminary business plan. Such a pre-project approach would have guided IDRC decisions to support the project or otherwise, as well as providing strategic direction to the project's possible implementation. It would furthermore have helped to provide for a more appropriate research team profile (identification of the need for members with experience in commercial project development for inclusion within the project team).

5.5 PROJECT IMPACT AND REACH

To date, the only beneficiaries of the project have been the project's associated research team.

No detailed economic feasibility study has yet been carried out. The Project Leader revealed that plans were advanced for the incorporation of a starch manufacturing company (the equity of which will be held by the University and the Malawi Development Corporation). This investment wil require set-up capital of about MK20 m.. However such funding is reportedly based on the capital cost of identified rehabilitated plant and equipment. No full financial appraisal has yet been done for the new project. Therefore no operating costs or other information were available to the Consultant.

This intended new industrial initiative will involve the setting up of a company-owned cassava farm. The Consultant was told that the farm would supply the factory with 15 tons of cassava per day.

There is no further consideration of the commercial project being of advantage to small-scale farmers. Such a raw material requirement would imply an adhesive output of over 4500 tons per year, which vastly exceeds the Malawi market offtake levels as indicated in the market survey (see 5.1).

It would appear that this project has very little impact or reach potential, particularly in the context of development. The absence of a more thorough investigation at the project proposal stage (and of more of a commercial orientation to the Project itself) has meant that the Project has been deflected from its original values and ideals. What is evolving would appear to be a commercial operation that will not have a wide nor particularly significant national benefit.

In the context of wider development interests, the IDRC's research investment in this project has undoubtedly been expensive relative to any accrued benefit.

5.6 MAJOR FINDINGS AND LESSONS

This project strongly emphasises the need for accurate project appraisal and thorough project preparation.

5.7 APPENDICES

The following three Appendices relate to this Project and focus on technical references, people interviewed and Malawi cropping statistics.

Appendix 5A

REFERENCES AND CONTACTS MADE

References:

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Contacts Made:

Dr. E.Campiano (Project Leader and Vice-Principal, Chancellor College)

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APPENDIX 5B

CROPPING PATTERNS OF THE MALAWI SMALLHOLDER SECTOR

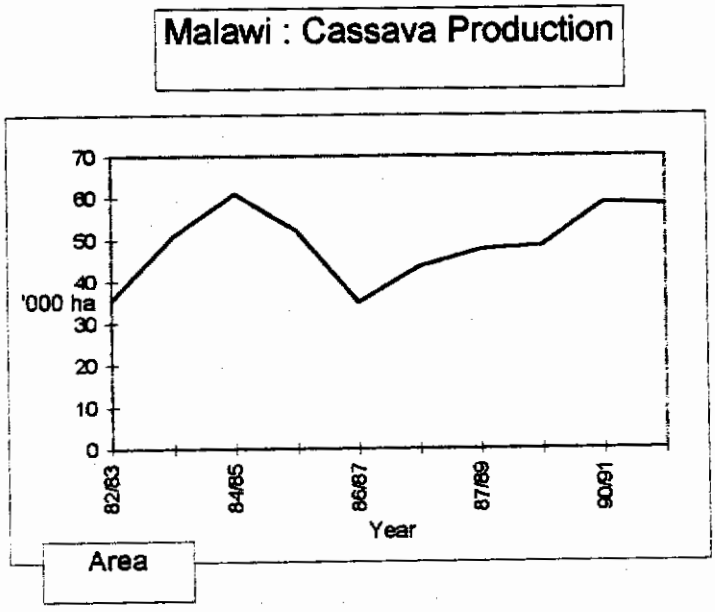
BY HOLDING SIZE (%)

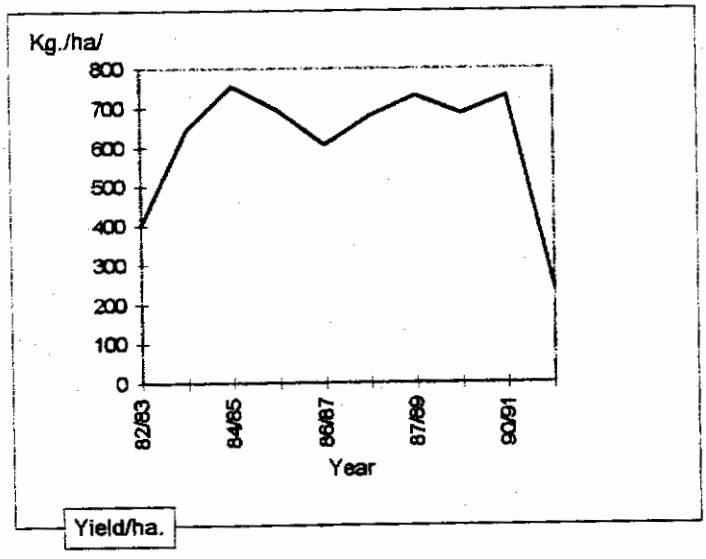
CROP TYPE	<0.5 HA	0.5-1.0 HA	1.0-1.5 HA	1.5-2.0 HA	TOTAL
Hybrid Maize	1.6	1.7	3.2	4.5	4.1
Other Maize	80.3	76.9	70.7	63.5	66.1
TOTAL MAIZE	81.9	78.6	73.9	68.0	70.2
SORGHUM	0.3	0.7	0.6	0.4	0.6
CASSAVA	6.2	3.1	2.1	1.8	2.3
ALL FOOD CROPS	93.3	87.2	80.7	75.1	77.9
ALL CASH CROPS	5.7	11.1	16.7	20.8	21.8

Source: Annual Survey of Agriculture 1988

NOTE: 87% of Malawi's 1.6m. smallholder householders farm on landholdings of less than 2 ha.

Appendix 5C





Source : NSSA