RICE PROCESSING PROJECTS IN BANGLADESH
AN APPRAISAL OF A DECADE OF PROPOSALS

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ABSTRACT

In Bangladesh, about 65 percent of paddy production is milled by traditional methods, about 25 percent by small huller machines and the remainder by major commercial mills. In the last decade, more than 25 proposals for commercial rice processing projects have been put forward by various agencies. All the proposals involve foreign exchange component. Very few of the proposals have so far been fully implemented. This paper critically examines the assumptions on which the proposed projects were formed and follows through to the implemented projects in order to assess whether the assumptions made in these proposals are realistic for Bangladesh.

I. INTRODUCTION

In Bangladesh about two thirds of paddy production is milled by women in their homesteads using the wooden dheki; about a quarter is husked in small huller machines and the remainder - 5 to 10 per cent - finds its way via beparis or bulking traders to the major commercial mills, and thence to urban final destinations. These -major mills", located in the most important centres of both production and consumption are usually batteries of no. 2 hullers operated in conjunction with paddy-rice separators off line-shafts powered by electric motors, diesel or steam engines. Their owners may operate wholesale businesses and/or may work on contract to the Food Department milling paddy procured by the Government. The technology and economics of operation of major mills have been documented variously by Choudhary (1970), Agricultural Marketing Directorate. (Bangladesh 1972, 1974) and Tickner (1974) to whose works those interested should refer.

In the last decade however a number of proposals for rice processing projects have been put forward by private individuals, co-operatives and by Government specifically for the commercial sector. 25 are known to this writer and their

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number appears in danger of swelling exponentially. These proposals all involve foreign exchange components; some may be externally financed. At present at least 5 departments, banks or corporations are known to be taking independent decisions on these technological innovations and to date very few of the 25 have been fully implemented.

Similar proposals in India and Sri Lanka are known to have faced both formidable and fundamental problems in implementation and operation. Lele, 1971; Harris, 1976, 1977a and b) They have also become progressively capital intensive and labour displacing as time goes on, and some require continual and substantial subsidies to remain in operation. Yet in those cases where formal project appraisals were carried out, these technological innovations showed high profitability at market prices (e.g. Faulkner, Reed and Brown, 1963, for India). It would seem therefore a matter of some priority to examine the proposals for projects for the post-harvest processing of rice in Bangladesh and in particular to try to look in a constructively critical way at the assumptions on which they are based, and to follow through those implemented in order to assess whether the assumptions made in these proposals are realistic for Bangladesh.

The following paper endeavours to do precisely this, with the additional intentions of attempting some generalisations about projects conceived in (sometimes competitive) isolation, and of providing a checklist of factors (given in Appendix A) to be considered in the selection of rice processing technology. The writer is a social scientist, not an engineer and apologises for any engineering flaws thus committed.

Of the 25 projects known to have been proposed, documentation on 18 has been obtained in 14 reports. Furthermore, one implemented project was visited and full details obtained with the co-operation of the engineer in charge and the manager. And for a foreign aided drying project, the engineers in charge were interviewed and their report used. A number of most recent projects are, and will be treated as, confidential. We will appraise the proposals in their order of appearance over the last decade or so. Summary details are given in Table I and should be referred to in each case. For ease of reference a list of the project documents used is given in Appendix B at the end of the paper.
II. APPRAISAL OF PROPOSED PROJECTS


This is a proposal made *inter alia* as the result of a study trip on industrial estates, small industries and industrial development organisations in Asian countries. The technology proposed had been seen in use in Burma and Japan and involved the extraction of edible oil for cooking from rice bran by the solvent process. 25 ton per day plants were observed in Burma and these were costed for Bangladesh. The annual rate of return on capital invested in a plant in Bangladesh was calculated as 84 per cent which is extremely high.

The necessity for such a plant was gauged from the demand side by statistics for the annual requirement of edible oil (170,000 tons) and annual production (27,000 tons) with severe agronomic constraints on increasing this production. On the supply side, statistics for the production of rice bran could be interpreted as being able to support 20 bran oil factories which would meet 10 per cent of East Pakistan's deficit (p.112). It was assumed that with "sustained effort" small custom mills would supply bran (instead of allowing farmers to return home with it) and that "a systematic trade channel will automatically follow (from homestead, dhek, operators) if there is an industrial demand for bran (p.111)." Both these assumptions are highly dubious given the logistic difficulties of organising transport of bran to factories, given transport costs (neglected) and last but not least given the opportunity cost of bran: its domestic use as an animal feedstuffs in a subsistence agrarian economy.

Actually only one factory was costed. It was suggested for Dinajpur where there is the highest concentration of commercial rice mills, with a commercial market for bran.

In the costing, 100 per cent capacity utilisation was assumed which is highly unrealistic (p.111). The foreign exchange component at 54 per cent of capital costs, is high, and the bran oil factory's spare parts were all to be imported, a continual drain on foreign exchange. Only one year's spares were included however and slow moving spares which would add to operating costs over time were omitted. Storage costs were also omitted and the basis for the pricing of the finished product—edible oil, in a notoriously volatile market—was not given.

This project has not been implemented.

So far as is known this is the earliest proposal for modern rice mill technology in Bangladesh. It is a project proposal masquerading as an investment guide. It consists of a fully integrated modern rice processing plant: mechanised preliminary paddy cleaning sizers, oil-fired automatic parboiling and mechanised drying facilities with a self-contained rice mill with 2 ton per hour (TPH) rubber roll shellcracker, cone polisher, paddy separator, rice grader and separator, bran separator and husk aspirator, all linked by mechanical conveyor belts and bucket elevators. The average annual rate of return was calculated at 35 per cent which is highly satisfactory. Most of the other projects we consider later are variations on this theme.

The necessity for such a technological innovation was not couched in terms of constraints on existing installed capacity but made appeals to modernism for its own sake: "It is the latest machine for rice milling" (p.2). "It is swift, efficient and economic" (p.3). It was set in the context of a planned 20 per cent increase in production over 5 years with the use of IRRI rice varieties. Paddy supply "will naturally create an additional demand for the services of automatic rice milling plants throughout the province" (p.1). Attempts were made to juxtapose figures on districtwise paddy production with the number of commercial mills working, but no indications as to potential locations were given. Its appropriateness to Bangladesh was justified by "doing away with labour" (this from a small industries corporation) and "doing away with the need for sun". The parboilers and dryers were to be oil-fired (since this was the only technology developed at that time). Now of course boilers and dryers may be husk-fired, and in the wake of the energy crisis, husk-fired technologies alone are potentially economic in competition with the much lower capital costs (but perhaps higher risks) involved in using the heat of the sun. The output of rice from paddy was assumed in the costings to be 70 per cent, capacity utilisation 80 per cent, neither of which have ever been achieved in South Asia. Storage for three months was built into capital costs, but capital locked up in stock was not costed. Transport was not costed. The foreign exchange component which was never as low as 23 per cent in succeeding proposals did not include imported spares. The form of organisation and administration of the mill was not considered.

This proposal was not implemented though it may have sown the seed of the much larger 3.5 TPH modern Rice Mill (M. R. M.) built in Comilla from 1970-3.
Revision of the 1966 Proposals (Document 3)

This is in fact a new proposal with costing for a 1-5 TPH mill machine and with an “appropriate” husk fired parboiling and drying technology. Its average annual rate of return on capital is lower at 15 per cent. Once again its necessity was confidently justified in terms of a vast increase of paddy production using high yielding varieties and, significantly, the following type of statement made its first appearance of many: “Since the establishment of Automatic Rice Mills are expected to gradually replace the uneconomic and time-consuming manual methods which at present are husking about 75 per cent of total paddy produced in the province, the automatic rice mills need not necessarily come into competition with the existing rice mills and husking machines” (P.6). This manifests a complete misconception about the social role of the aheki in the subsistence sector (see Harris, 1978). It also is suggestive of resistance to the automatic mill from the commercial sector itself. Furthermore, the proposal contains estimates that since all the existing husking machines, by utilising their capacities to the fullest extent, cannot process even 50 per cent of the total paddy crop (P.2) 30-40 MRMs were required immediately and 200-250 more by 1975. Data for 1970 shows that installed capacity for husking mills (let alone that for major commercial mills) could process three times the annual production of the province. (Food Department). Possible locations for this rash of mills were reduced to the 7 districts of the west and north, including Sylhet where paddy is actually milled raw, not parboiled.

In the costings, a reduced, more realistic output of 68.5 per cent was assumed but capacity utilisation was at 80 per cent. Otherwise the comments on the 1967 proposals stand.

This proposal was not implemented. We now turn to a really fascinating proposal contained in entirely different quarters, in apparent isolation from EPSC’s investment guides.


In 1970 Chittagong District Thana Central Co-operative Association put forward a proposal for a modern milling complex. The original document is not available and we have to piece together what it contained like a jigsaw from the
been underestimated and that the idea of replacing the dheki by MRMAs was somewhat unrealistic.

Young made two significant comments on the existing rice mill industry. One is that “IDBP and EFICIC have supported the establishment of the low cost rural” (huller) “mills and provide substantial loans towards their costs. The cost of processing is lower than with modern mills. Their competitive background must be kept in mind when considering the economic feasibility of any new MRM proposal” (4, p.7). Indeed, in fact the Chittagong area can be shown to have experienced one of the fastest expansions of commercial and custom mills in Bangladesh. Secondly he observed that automatic rice mills were being set up elsewhere: he quoted Comilla, and “as soon as their economic feasibility was demonstrated it can be expected that there will be a huge rush of applications and installations” (4, p.8). Why not wait for a while and see?

He also drew attention to the high foreign exchange component and the “extensive continuing requirement for imported spare parts” (4, p.9) explaining that the few rubber roll shellers at that time installed in Pakistan (West wing) were mostly idle because of “lack of spares and high milling costs.”

He pointed out that coating at 100 per cent capacity utilization did not accommodate “holidays, strikes, disturbances, power failure, breakdowns and raw material shortages” and that 65 per cent capacity would be more realistic (4, p.12). Furthermore since “a 2 TPM is the minimum economic capacity at which a MRM can operate” (4, p.10), the administrative skills in organising the logistics of supplying 40 tons of paddy to and 28 tons of rice and 25 tons of bran from each mill every day had not been foreseen.

Lastly the role of Government and of the funding agencies had not been spelled out; neither had the implications of co-operative ownership in the context of a master plan for the province which specified private ownership of industries. Interest rates for the loans were underestimated and finally there was an investment ceiling for rice mills which this project greatly exceeded. These are all substantial points of useful criticism.

Now there comes a remarkable reversal.

In view of these perceptive comments it was inevitable that Young be involved in advising the Chittagong Co-operative on a more appropriate technology. The results of his consultancy with a rice processing engineer also on contract to the Ford Foundation, Lahore, constitute document 5.

They advocate two smaller projects: the first a co-operative rice processing centre in Rangunia (the thans with the greatest production increases, and stron-
ggest co-operatives, the most marketed surplus and the largest number of installed commercial mills). This centre would comprise a fully automatic 2 TPH mill and could have satellite collection centres. The second is a paddy drying and storage centre for aus and boro crops at Chakania (5, p.1). They only costed the first project. They stated that they had "simplified the design, eliminated unnecessary extras and considered the balance between capital and labour and the necessity for operational flexibility" (5, p.3). Their project is the most capital intensive of any until 1978, and, at constant prices, probably ever. It had a high average annual rate of return of 31 per cent on capital invested.

Firstly let us look at their technological specifications in the light of Young's earlier comments. Young pointed out in document 4 that Chittagong was a raw rice milling area. Recognising this, they state in document 5 that the automatic parboiling unit included in the project "can be used optionally" (5, p.4) but of course was not costed optionally. The parboiling unit was to be husk fired, but on the one hand a complete oil fired unit was included "if husk should run short" (4, p.19) (unlikely in the context of predominantly raw rice milling) and on the other hand a special husk hopper was included to feed husk to trucks "for export if husk was in excess" (5, p.20). On page 20 again they state "if operated efficiently the parboiling unit should not require external fuel and can do parboiling and drying" (5, my italics). This hardly seems a case of "eliminating unnecessary extras" (5, p.1).

On mechanical drying, Young had already observed that "a low capacity drier was adequate for aus and boro supplies" (4, p.13-14) and advocated a husk fired drier (4, p.17) especially if little parboiling was to be done. In the new proposal they state that husk can fire the drier as well as the parboiler, and yet they proposed to install an oil fired drier (5, p.17). The proposed installations would operate at 21 per cent of their capacity and they suggested that to increase this, these bulk driers be separately used to dry the small consignments of subsistence farmers from the surrounding areas.

Now let us turn to the market justification. They claim that the automatic rice mill has markedly high outturns (5, p.4) whereas Young stated earlier that the district's output was as high as any mill's (4, p.17). (Actually it is not really known whether this is true). They justify the automatic mill on the grounds of its producing rice of premium quality capable of earning premium prices whereas Young stated earlier that premium quality was not high priority in East Pakistan (4, p.46). (Actually there is no evidence for premium prices for high quality in Bangladesh, and the price differences between top and coarsest varieties
is only 20-25 per cent here (K. Maziruddin, 1978, Pers. Comm., and Agl. Mkgs. Directorate price data) compared with approaching 100 per cent in S. India, for example. They themselves recognize this later on (5, p.21).

In their costings they assume the problematical outturn of 70 per cent (which necessitates a low degree of polish and therefore a lack of market premium, and which is only very rarely achieved for raw rice milling). And in spite of Young's criticisms of costings at 100 per cent of capacity (4, p.12), they cost operations using a 20 hour day, a 360 day year which some have interpreted as "engineering capacity" (see Lele, 1971) and which in any case is greater than the 65 per cent advocated earlier by Young. They state "Modern mills in most other countries of the world operate on this basis" (5, p.5) but this is simply not true in South Asia (see V. K. Gupta, 1970).

They fail to impute the cost of husk and include spares sufficient for only 6 months (5, p.32) (which rules out costly slow moving items).

Their specifications and costings for storage merit comment. In their proposal are 8 x 50 ton receiving bins and 8 x 200 ton paddy silos. The justification for 8 of each type is so as not to mix paddy varieties and they assume 4 different varieties. Bulk storage is problematical with mixed paddy. By 1971 Indian evidence had been published and in circulation for 2 years from a seminar (attended by the engineer on this Raungunia consultancy) for the highly uneconomic nature of bulk silos (see Indian Institute of Management, 1969). Further expansion in India of silo storage for paddy had already been abandoned. Silos were justified here in terms of eliminating gunny bags (5, p.19) when

(a) Bangladesh is the cheapest bag manufacturer in the world with jute mills on the doorstep in Chittagong itself

(b) Unless bulk transport was envisaged (which is not clear—see below) gunnies would have to be used and

(c) costings are actually included for 10,000 gunny bags! (5, p.32).

Young criticized in 1970 the neglect of aspects of transport (4, p.15-16). In 1971 they rely on hire from the free market for the transport of supplies and mention trucks and boats (but not bullock carts). The unloading schedule relies on upending trucks and tipping out 5 tons every 15 minutes (5, p.14-15). The receiving equipment was designed at double capacity—25 TPH—to cater for peak times, which therefore implies that 5 ton lorries can be upended, unloaded and jacked down again in 7 minutes. This seems optimistic ad absurdum. Truck parks and access facilities for this kind of queue were not catered. The screw auger for bulk unloading from boats assumes bulk transport in boats. Screw
augers are well known to be one of the first casualties from abrasion from the siliceous husk of South Asian paddy.

Management is proposed to have responsibility over and above the operation of the mill and its satellite purchasing centres for

(a) developing speciality markets to capitalise on the price premium such rice would bring (5, p. 21);

(b) organising boats and trucks (5, p. 12) (there is a well known law and order problem with large scale boat transport of foodgrain in rural areas);

(c) being "careful", "dynamic, honest and professional" (5, p. 3-23). They state that in the complete absence of such trained personnel in Pakistan, managers should be trained at the MRM at Comilla, Kotwali Thana Central Co-operative Association (5, p. 23). We shall turn to the experience of this mill next.

Not surprisingly this proposal has not been implemented. Since its actual assumptions are precisely the reverse not only of its stated purpose but also of Young's earlier comments on how such projects should be formulated, one can only conclude that it can never have been intended to be implemented and, if so, merely wasted consultancy resources.

But this is not the end of the story. Now it was the turn of the engineer, Wimberly, to visit Rangania again in 1974 and put forward a new proposal (Document 6). Setting the background to his project, he noted low paddy prices and fluctuating surpluses and the necessity for labour intensity. He recognised the need to consider the paddy purchase system, design and investment cost details, rice marketing programme and training of staff and management; and the need to "plan from the operations side" (6, p. 1-7). He points to the "low economics" of a bulter rice mill and costs a bulter project proposal where a 65 per cent output is assumed and where 83 per cent of the capital costs of the project (3 lakhs) is buildings and roads (6, p. 10-13). He suggests that with existing technologies post harvest losses are 15 to 38 per cent and average 20 per cent (6, p. 11-17) (post harvest losses can of course be up to 100 per cent in a flood, but we need to know about measured average). He says "we have learned in India and Sri Lanka that modern techniques and equipment can reduce the losses to nil". There is no foundation for such a statement. He points to "low quality rice from antique storage, drying and processing" (6, p. 21).

His new, 1974 model for Rangania is a Paddy Storage and Processing plant.

Rangania T. C. C. A. was to purchase paddy at a "guaranteed support price", transport it to a processing plant and market "high quality rice elsewhere"
(6, p.24) or "in near areas" (6, p.29). They would have to be "near", because there is now no parboiling facility envisaged. 6 batch driers capable of drying 2 tons in "3 to 6 hours" (presumably depending on initial moisture content) would be build together with $4 \times 500$ ton godawas, a 2 TPH modern rice mill and a rice store of 500 tons. The modern system was to be "labour oriented" and as such was estimated to have a "low" rate of return of 20 per cent.

The driers appear to be in excess considering the capacity of the mill. There are no operating costs for transport or for storage nor are there storage schedules even though one main rationale of the new system was the reduction of post harvest storage losses. The assumptions for labour generation are not given and the employment total not subdivided according to jobs even though the second main rationale for the project is its labour intensity. The output specification of rice from paddy is 70 per cent (raw).

To our knowledge this proposal was also not implemented.

Let us now examine the Comilla MRM which Young judged to be a test case for the profitability of the new technology (4, p.8) and Young and Wimberly rely on for the training of managers (5, p.23). This is the only automatic rice mill proposal actually to have been implemented in Bangladesh.

5. Comilla Modern Rice Mill (1970-3)

This automatic rice mill was the brainchild of Dr. A. H. Khan, a civil servant who also fathered the Comilla Co-operatives and the Bangladesh Academy for Rural Development. Watching the production increases under the Comilla experiment and mindful of problems with the repayment in cash of highly subsidized loans in cash and kind to farmers, and the diversion of marketed surplus to the ubiquitous custom mills (and the possibility of their crossing the international border close by to Tripura State in India), observing problems with flooding and wet season paddy drying, he conceived a plan for a 3.5 TPH MRM i.e. an engineering capacity of 21,000 tons per year. This was to process the paddy of some 20,000 farmers who were members of 400 agricultural co-operatives under the Comilla scheme.

The site selected was on a "cottage" industrial estate, in, but on the fringe of, the town of Comilla. A co-operative workshop was close by, the railway was within two furlongs (far enough away, however to necessitate an extra break of bulk), and corrugated iron buildings already existed to house the factory and a godown and offices. Originally costed at Tk 325,000 in 1970 the project finally
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cost 36 lakhs (in line with other contemporary proposals). Yen credits for the imported Japanese machinery were sanctioned by the Industrial Development Bank of Pakistan, now the Bangladesh Shilpy Bank, at an initial interest rate of 5 per cent which has since then naturally been increased to 13 per cent.

The machinery was operational by March 1973. Since this time its throughput has been as follows:

1973-4 1866 tonnes (9 per cent of engineering capacity)
1974-5 negligible
1975-6 186 tonnes (1 per cent)
1976-7 negligible
1977-8 1866 tonnes (9 per cent).

The mill is for sale but there are no tenders. In spite of this we observe a spate of applications for similar technologies. Its total processing costs are approximately Tk 20 per munda. The mill now operates through the special dispensation of the Food Department which allocates paddy at 150 per cent of the normal milling commission to hullers. A sun drying yard has been constructed and "country" soaking and parboiling methods are being used for premilling processing. Inside the factory, the two furnaces (one completely oil fired, one 80 per cent oil and 20 per cent husk fired), the 6 x 2.5 ton parboiling tanks, the 3 TPH rotary drier, the 16 x 7 ton tempering bin, the 18 TPH baffle drier and the conveyor belts, screw augers and bucket elevators to link these machines have lain completely idle for a year and are virtually unused since 1974.

This is a rather serious situation for the only fully automatic rice mill in Bangladesh and its performance needs to be seriously explained. Reasons for its low capacity utilisation include the following:
i) Location: Comilla is not a surplus district and paddy production in a classically minifundist agrarian society is geared to subsistence (see Huq, 1976; Bertocci, 1976).

ii) Site: Though adequately laid out on the site itself, the approach to the mill is urban, residential and industrial without straightforward access either to sources of paddy or to rolling stock.

iii) Supply of Paddy: Marked surplus has not matched predictions, in any case consisting of the very small and scattered consignments of minifundist farmers which pose problems of storage (since paddy varieties are often mixed) bulking (since the limiting consignment of a lorry load may take time to amass, and damp and inevitably poor quality paddy may deteriorate meanwhile) and transport.
(since paddy loses a third of its weight on milling which gives the advantage to smaller, decentralised mills). Paddy purchase price in co-operatives is lower than that on the free market and the default rate on loan repayment is high.

iv) Transport: Above cost considerations, it has proved extremely difficult to organise privately owned lorries, and the labour necessary for loading and unloading at the mill was not foreseen.

v) Storage: Capacity exists for 15,000 maunds (~560 tonnes – greatly in excess of that allowed under the hoarding laws) but is severely underused for its rent of Tk 600 a month.

vi) Technical problems with machinery: There are 4:

a) Unexpected maintenance problems (well known in South Asia before the installation of this machinery in Bangladesh) occurred with corrosion and wearing of the screw augers and bucket elevators which link the machines. In the MRM, paddy has to be lifted through about 10 metres five times. A breakdown in any one of the elevators stops all the machinery since labour cannot be substituted.

b) The two furnaces are basically oil fired. One has been half converted to husk but the blower is of lower capacity than furnace, and the husk has a lower combustion value than anticipated, and paradoxically all the husk is never used. The cost of fuel renders the rotary and baffle drier (as well as a smaller 3.7 ton drier left from the DANIDA project discussed next) uneconomic.

c) The life of the rubber rollers is 30 to 50 per cent that specified by the Japanese manufacturers (also well known elsewhere in South Asia before the installation of this machinery). Also the imported rollers are subject to the common uncertainties of availability.

d) The final outturn of rice contains a far larger percentage of broken than was specified, possibly because of differences between Japonica and Indica paddy.

viii) Pricing: There is no expertise for, nor any ideological commitment to free market operation. The present Food Department commission of Tk. 5.5 per maund for contract processing of procured paddy adequately reimburses the hulker with its low pressure parboiling technology (total processing costs are estimated elsewhere as Tk6a 3.4 (Harriss, 1978) ), but not the MRM.

Having examined operational problems in the automatic rice mill, it may be instructive to look at the constraints on implementation of a rather different kind of project for the post harvest processing of rice. Briefly, against the background of the creation of a small graveyard of imported mechanical driers in Bangladesh, DANIDA experimented over two years with different mechanical drying technologies at the level of farmers' groups. The technologies were:

i) a deep bed storage drier with two chambers, capacity 28 tons;
ii) a drying platform with holes for sacks, and hot air underneath;
iii) another sack drier powered by the diesel engine of a pump;
iv) a portable 2 ton capacity husk and kerosene fired drier;
v) a 40 chamber batch drier with capacities of 10 maunds per chamber.

The DANIDA report is to be commended for its honesty and explicitness. Constraints on operation of such technologies can be summarised from the details of their experience as follows:

i) Technical Specification: Known technologies are of too large capacities for farm level consignments with different varieties, different amounts and different initial moisture contents. They also usually dry more slowly than is tolerable (56 hours). Use of a mechanical drier is seasonal and even then intermittent within seasons. Husk is fully used domestically. The capital and operating costs are at least 5 times the maximum that farmers will pay. The pilot project was commensurately uneconomic with Modern Rice Mill, Comilla. Andersen and Hoberg conclude: 'There is no technology available for conditions under which farmers will not mix their paddy' (7, p. 42). (It is clear that some potential may still exist at the level of the commercial mill, though, see below).

ii) Institutional Factors: The potential for farmers to co-operate over paddy drying was proved very limited even in Comilla district. Co-operative ownership of damp paddy led to its deterioration through lack of responsible management (perhaps because men are not traditionally the custodians of stored paddy and are less experienced in this respect than are their womenfolk). The organisation of transport is problematical. Electricity is most prone to lengthy breakdown during precisely the seasons of the year when mechanical drying has most potential.

iii) Management: Additional problems were created through the very high turnover of local skilled and qualified counterparts on the one hand (which
reduced the effectiveness of the training given under the project and insufficient unskilled labour on the other, a situation exacerbated by the tendency (again characteristic of other parts of South Asia — see Harrison, 1978b) of unskilled labour to demand rigid and micro precise specification of their roles.

iv) Location: Deficit districts for rice, with little marketed surplus such as Comilla, are unsuitable for modern post harvest processing projects, irrespective of their reputed social progressiveness. The potential of giving a multiple use to the irrigation pump motor at the micro level of the site, (or the tractor engine) founders on the problem that there is no necessary conjunction between irrigation and the production of wet season rice, although pumps would not be needed at the time of the wet harvest.

v) Basic Assumptions: Empirical evidence quoted in the DANIDA report (of farmers’ ability to cope with wet season drying using traditional practices, of their removing paddy from mechanical driers whenever the sun shines; and of millers’ often not receiving enough paddy for wet season drying to cause losses (Rahman, 1978, Pers. Comm.) suggests insufficient evidence of a general case for modern technology, as well as great micro level variation in this potential need.

We shall try to draw some further general conclusions about constraints from these examples of implemented projects in rice processing later on. In spite of these known problems, and the lack of evidence of feasibility, proposals for automatic post harvest processing facilities proliferate. Let us now turn to the latest generation.

7. Ministry of Food: 5 x 1.75 TPH Government Rice Mills, 1977 (Document 8).

The Food Department has submitted for external financing a proposal for 5 x 1.75 TPH MRM’s each with a yearly capacity of 8,400 tons of paddy. With the exception of Patuakhali, the mills are to be in districts in the north and northwest, evenly scattered. They consist of the standard automatic technology. To recapitulate: husk fired parboilers and driers, rubber roll sheller mill with polisher, grader and bran separator, linked with mechanical conveyors and elevators. The proposed technology is Indian.

At present the Food Department procures paddy and distributes it to contract-commercial-millers on a commission basis for processing. Government procurement of paddy has been increasing of late. In the 5 districts where Government Rice Mills are proposed 7 lakh maunds were procured in 1974, 60 in 1975
and 50 in 1976 (Document 8, Annexure R). The Food Department's reasons for advocating direct ownership of processing facilities rather than continuing the contractual arrangement are not known. The mills proposed are not of marginal importance however. If milling at capacity they could replace existing molar mills in their respective districts when milling at their present throughputs. However, put another way, if we ignore the number of commercial mills lying idle (20 per cent) and if we assume that the actual commercial mills could operate at the capacity specified for the proposed mills then what the Government procures is only 44 per cent of capacity in Rangpur, 36 per cent in Mymensingh, 11 per cent in Bogra and Dinajpur and there is only a clear case of raising capacity in Patuakhali where procurement appears to be 400 per cent of installed capacity in the molar mill sector.

A few further comments must suffice. Output (67.5 per cent) and capacity utilisation (67 per cent) are fairly realistic. Foreign exchange of Tk 1 lakh is allowed for each year for spares, yet machine maintenance is costed at only Tk 30,000 leaving an unexplained discrepancy. Transport of management personnel is budgeted (one car), but that of raw material is neglected, as is storage.

The costing shows that these 5 mills are uneconomic unless they have a 40 per cent subsidy on operating costs. The other viability condition is that Government's output specifications should be raised from 65 per cent to 67 per cent. The implication is that such a change would put conventional commercial mills out of business whereas the likelihood is that the latter would merely sell less "residue" on the free market.

This project awaits funding.


On Liberation, EPSIC became BSCIC. BSCIC finances projects under Tk 25 lakhs, and strongly discourages its former practice of giving loans for the installation of boilers. Project X is that of a miller from a region which is dominantly a raw rice milling one. It is for the normal technological package except that conveyors and elevators are not specified. And the parboilers and driers are to be fired by heavy oil (a technology vulnerable to the costs and uncertainties of imported fuel and questionable in view of the local raw rice market). The technology is from Taiwan.
Interestingly the project is not justified in terms of market demand so much
as in terms of the contentions that it is
i) foreign exchange saving
ii) import substituting
iii) employment generating.
Justifications (i) and (ii) assume that the imported machinery will result
in such a substantially increased output as to merit the foreign exchange
component (see Table 1 for these details). Yet the output cost is 66 per
cent which is realistic but hardly a striking increase over existing domes-
tically manufactured machinery, especially for parboiled rice which is presumably
the purpose of the parboiling machinery. The net effect of the mill is actually
likely to be neither foreign exchange saving nor import substituting but the
reverse. It is not likely to be employment generating either for the very obvious
reasons that its installation will merely increase the underutilization of existing
capacity and divert paddy (if it is operationally cost effective) from more
labour intensive commercial mills. Its net effect may well be to displace jobs.

In the proposal's costings, the output—66 per cent—and the capacity utili-
sation—30 per cent—are realistic, imported spares are costed at only TK 10,000
per year yet machine maintenance is TK 16,500.

Most important, however, are the prices for paddy, rice, bran and husk used
in the costings of profitability. The prices selected result in an average annual
rate of return on capital of 25 per cent. Inserting the prices reported to this writer
in a field survey of milling in January 1978 into the same calculations leads to a
net loss of TK 209,400 per year.

Funds have been sanctioned for this proposal.


This is a very similar project to the last, costing half as much again, at twice
the capacity and with a lower stated rate of return on capital: 21 per cent. In
the technological specifications the conveying machinery is once again not itemi-
sed (because local?), the fuel for the parboiler is not clear and the drier is a
rotary suction one using heavy oil as fuel. The technology is from Taiwan.
The justification is repeated from proposal X (or vice versa) and is subject to
all the previous caveats. The region in which it is to be located already has a
very large installed capacity, but no mention is made of this in the proposal. Outt-
turn, capacity utilisation and spares are all realistically costed. Transport and
storage are not considered, nor are tempering bins. The acute sensitivity of profits
to prices is maintained. With early 1978 prices for the products and by-products
this mill would sustain a net loss of Tk 327,000 annually.

Funds have been sanctioned and 2 similar projects are reported to be in the
pipeline. They ought at the least to be tested for price sensitivity.


This project is financed by a para-statal industrial bank and is the largest in
terms of capital investment. It is a 2 TPH mill with the usual machinery and
husk fired parboilers and drier (but not tempering bins?). The technology is
Indian and British.

The location for this mill is in a region with a mixture of parboiling and raw
milling. Existing installed capacity is calculated by the investor (who has a
career in management) as 22 per cent of production, whereas this writer's calcu-
lations make it 135 per cent of production (let alone marketed surplus). The
necessity for another automatic rice mill is not proven. The planned modus
operandi is expected to be on contract to the Food Department, and also to local
private traders. Measurable increases in output over that of installed mills are
anticipated. Costings on spares appears realistic. For the costings capacity is
assumed at 80 per cent of maximum, which is too high, and output is specified
as 67 per cent in the text but 66 per cent in the costings. Storage costs and trans-
port costs are not considered. The costing of profitability is again sensitive. The
Food Department Commission of Tk 4.50 per maund is assumed. If the same
throughput is costed as a trading enterprise with average prices and by-products as
in the writer's field survey (Paddy Tk 99 per maund, Rice Tk 132 per maund,
Husk Tk 3 per maund and Brann Tk 15 per maund) the enterprise sustains a
net loss of Tk 374,600 annually.

The project is currently under consideration for funding and there are three
others like it in the pipeline. The Shilpa Bank have also helped to finance a 24
bakh modern mill at Chowmohoni consisting of a 2 TPH British shell, husk fired
parboiling machinery and sun drying, prospects for which may be better than for
those considered in detail above.

Apart from these, the Krishi Bank is managing a project under which 13 x 1 TPH Japanese shelter mills and 10 approximately 2 TPH oil fired driers (also Japanese) are to be imported into the private sector. The uptake is slow at present. A private 2 TPH automatic rice mill costing Tk 25 lakhs is proposed to be built on a turnkey basis in Mymensingh using Indian technology; and BSCIC tentatively proposed the massive financing of 509 x 1 TPH rubber roll shellers with cone polishers and paddy separators for operation in the private sector.

The costs of these projects pale into insignificance beside two further public sector proposals currently at appraisal stage. One is for mechanical driers to expedite procurement programme and stabilise the foodgrain market structure. "Because of wet sales to Government in all seasons, Government does not have the option but to go in for drying facilities in a moderate way." But what is proposed is massive: 5 paddy drying plants of 6,000 tons capacity for paddy within a 10 mile radius of each other, and 10 complete automatic drying plants, plus 5 x 1,000 tons storage silos for a 1-2 year buffer stock, mechanical handling equipment and tempering bins.

Now the fact that the Government is stated as facing supplies of wet paddy for voluntary procurement in all seasons including "monsoon" is suggestive of institutional rather than climatic problems. Whether 6,000 tons of paddy can possibly be procured within a ten mile radius of each of the driers is doubtful. It depends on the physical production of surplus as well as price incentives for procurement (and the Government at present operates a floor support policy). Transport costs were stated as excessive if the supply area exceeded 10 miles. The problems of staggered supplies of different varieties, qualities and moisture contents are not broached. Silos have proved uneconomic in India because of the high fixed cost component requiring extremely high levels of capacity utilisation of break even, as well as because of technical difficulties (see I. I. M., 1969). The condition of paddy in the interior of a silo in the hot and often moist climatic conditions of South Asia has proved problematic and hard to monitor (de Padua, 1974). No operating costs have been supplied for this project.

Secondly, the construction and marginal rehabilitation of a total of 190,000 tons of storage in exactly the same districts as the bulk driers has been proposed. The exact type of storage technology for the 150 x 500 ton storages is unspecified but it is more likely that it is flat bag storage than silos. Driers are also mentioned but no details are given in the proposal.
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60,000 tons of go-downs have already been constructed for procurement in these districts and procurement figures for a bumper year – 1973 – suggest that a doubling of present storage is probably desirable in three of the five. An increase of this magnitude is apparently already planned under another project. The combined investment of the two new proposals however appears so much in excess of requirements as to require very careful explanations of the assumptions about procurement which underlie the proposals. Once again these independent projects are not marginal, and, if implemented, will affect each other.

III. CONCLUSIONS

From this review of rice processing proposals, 10 hopefully constructive remarks seems to be worth making.

i) Bangladesh has a chronic employment crisis. In rural areas unemployment is rising (Clay and Khan, 1977) and real wages are falling (Clay, 1976). Clay has shown that rural unemployment will increase even if food self-sufficiency is attained as planned (1978). Yet Table 1 shows that the proposals submitted for funding are increasingly capital intensive. Labour costs expressed as a percentage of capital costs, and as a percentage of total processing costs decline during the decade. On average it requires Tk 105,000 to create a skilled job in automatic rice processing, and Tk 87,000 to create an unskilled job. In the huller sector it costs Tk 17,000 and in the homestead sector where output and quality are recognised as just as high as in a factory, Tk 195 – the cost of a dhek and parboiling equipment (see Harris, 1978a). Other things being equal, Government institutions committed to employment generation should not be displacing labour amongst the target groups for development. Yet that is what appears to be being proposed.

ii) The obsession with automation manifested in the proposals is counterproductive. The main reason why proposals do not even get to the implementation stage is that it is clear that these mills are over-capitalised for a free market in which paddy and rice margins are quite low (Farrouk, 1970, p.121). Because of their large scale, automatic rice mills pose obvious large scale transport and storage problems which, if uncoated, detract from the estimates of cost effectiveness.

iii) Proposals are very often characterised by a number of false assumptions. Examples are that a projected vast increase in production will materialise, and that if it materialises it will result in increases in marketed surpluses such as to necessitate automatic rice mills; that existing capacity is inadequate; that an
automatic rice mill can replace the dheki; that existing milling technologies have high waste (very little is wasted in Bangladesh); that mills can operate at higher capacity than any other type of manufacturing enterprise in Bangladesh; that mills with parboiling facilities are appropriate for raw rice areas in Bangladesh; that prices are stable. Proposals put together in a hurry are likely to have such unrealistic assumptions built in. High quality and realism in project formulation necessitate familiarity with local resources and take time. There are no short cuts.

iv) There are problems in the implementation of modern technologies independent of their project formulations. In particular we can note organisation and management (especially in the public sector) of the large scale machinery, in the face of relatively small consignments, mixed varieties and mixed moisture content (even assuming all the paddy is clean). We can note the vulnerability of sophisticated technology to breakdowns, to any uncertainties in the supply of raw materials or spares, or, for that matter, management. We can note the much more acute sensitivity of profits to changes in prices, and to changes in the policy environment in which they must work, than with local technology. Finally we can note the larger marginal costs associated with the inevitable neglect of local elements in complex processing systems. Bangladesh would do better to think of using institutionally robust technology not vulnerable technology.

v) On the other hand it appears that it is not always very necessary to demonstrate economic feasibility. The presentation of data in these project proposals is not always very assimilable. Decisions are not always taken on economic or social grounds. Inexperience (inevitable with new technologies) has led to the international replication of costly mistakes, as the stories of the silo, the oil fired furnaces and the mechanical conveying equipment in South Asia show.

Decisions are often taken in quite remarkable isolation, even within banks, in ignorance of the history of past projects elsewhere in the country or internationally in relevant countries (which this paper is intended partially to remedy). Decisions, both public and private, are taken in ignorance of present projects and sometimes in ignorance of the particular technical factors which make the economy of Bangladesh unique. This is a big problem and calls for the highest level scrutiny.

Problems of information are further multiplied now that automatic rice mill machinery manufacture is not simply the preserve of Japan, Germany and
the U. K. but has diffused to Taiwan, Korea and India. Much more data needs to be assembled before costing, and the expertise required to judge between sales brochures (which are by their very nature biased) increases.

v) Opening up the domestic market to the international deluge brings all manner of second generation problems connected with the multiplication of types of spares, particularly crucial for rubber rollers. These second generation problems raise the cost of projects very often after they have been turned over to local people for operation. That import of a large variety of almost identical technologies may be dysfunctional can be seen from the diesel engines, lift irrigation technology, power tillers etc. either lying idle for lack of spares, or with lifetimes far shorter than those originally specified because of maintenance problems. To attack this problem requires not only a realistic sense of the vulnerability of different technologies but possibly some unpopular controls on the variety of any one technology imported, and highly problematic coordination of international “aid”.

vii) The proposals appraised are scattered throughout the country which brings problems not unrelated to the last point about supplies of spares. These projects are curiously interstitial in their sitings. Many with full parboiling equipment are scheduled for raw rice milling districts. There is no consensus on regional priorities and one suspects a strong element of “native-place bias” in the sitings. The commercial sector is so small that no project can be considered marginal (which they all implicitly are in present proposals). If successful (and there is enough a priori evidence to doubt this in many cases) these independently conceived projects will affect each other as well as the existing mills. And the plans of Government for post harvest processing will affect the on-going plans of the private sector. Since there is a high probability of this effect being negative to both parties, then all the independent decision taking of the present smacks of luxury.

viii) The similarity of all the proposals makes one suspect either lack of pragmatism or constraints on applications for foreign exchange for post harvest processing, neither of which are in the country’s best interest. The approach is to replace and displace, not to repair and improve. No-one has examined the 20 per cent of mills (at least) which are lying idle, to find reasons for their idleness. Incremental improvement (such as husk fired boiling systems associated with sun drying, such as under-researched improvements possible to the huller mill) which are intrinsically likely to be more cost effective are rarely considered.
has the opportunity to lead the world in research into incremental improvements to existing technologies.

ix) The number of unimplemented proposals represents a waste of manpower. It is not only that engineers and economists should work together on project formulation (which does not always happen here) but also that they should have better facts about the technologies, and about the socio economy of Bangladesh, at their disposal for planning purposes.

x) Given the combined impact of the latest generation of proposals there is now a very strong case for the establishment of a co-ordinating body with decision making power. This body might assess proposals in this specialised and important field; it might look at questions of ownership of technological capacity in the context of procurement and price policy; it might have a monitoring role; it might determine regional priorities for investment; it might suggest and monitor Research and Development (R and D).

It would have to be constituted from at least 6 Government Departments, from representatives of commercial interests, and from the research establishments. Its membership would have to be flexible because of the scattered distribution of the relevant expertise, which is not built up quickly, especially in a civil service where departmental transfers are regular. Given this situation it might even be worthwhile involving the occasional expatriate who has experience in implementation, provided communications were satisfactorily rapid.

There is no doubt that it would face formidable problems. Examples are: is it in the interests of international donor agencies to remain un-coordinated? Why is it that commercial millers do not have a long standing lobby here as elsewhere in South Asia? How would authority over the private sector be maintained? How would extension activities in the most important sectors-rural hulling and domestic processing-be organised? How would an arrangement between national R and D and domestic manufacture be guided through Government?

These are difficult issues, but consultants have been visiting this country and advising on past harvest technology for ten years (at least). The evidence is presented at length in this paper and is not very encouraging. That it is surely time for changes to be made is an easy conclusion and possible directions have been indicated. Whether these changes are practicable given Bangladesh's political economy when important decisions often have to be taken against severe deadlines and without crucial information, is much more problematical.
### Table 1: Proposed Projects in Food Processing in Bangladesh

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Date</th>
<th>Project Type</th>
<th>Capacity</th>
<th>Capital Investment (lakh Tk) (not incl. working capital)</th>
<th>Foreign Exchange element (%)</th>
<th>Total cost of processing (lakh Tk) (incl. raw mate.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1966</td>
<td>Rice Bran Oil Mill</td>
<td>7500 tons bran/yr</td>
<td>16</td>
<td>54</td>
<td>13.6</td>
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<tr>
<td>2</td>
<td>1967</td>
<td>Automatic Rice Mill</td>
<td>2 TPH</td>
<td>11</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>1970</td>
<td>Automatic Rice Mill</td>
<td>4500 TP/yr</td>
<td>8.4</td>
<td>36</td>
<td>18</td>
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<tr>
<td>4</td>
<td>1971</td>
<td>Automatic Rice Mill</td>
<td>12000 TPY</td>
<td>28.7</td>
<td>39</td>
<td>67.35</td>
</tr>
<tr>
<td>5</td>
<td>1977</td>
<td>Automatic Rice Mill</td>
<td>8.00 TPY</td>
<td>6.9 a</td>
<td>25</td>
<td>1.2 b</td>
</tr>
<tr>
<td>6</td>
<td>1977</td>
<td>Automatic Rice Mill (2)</td>
<td>1.75 TPH</td>
<td>15.4</td>
<td>48</td>
<td>141.6</td>
</tr>
<tr>
<td>7</td>
<td>1977</td>
<td>Automatic Rice Mill (2)</td>
<td>6000 TPY</td>
<td>10</td>
<td>48</td>
<td>62.8</td>
</tr>
<tr>
<td>8</td>
<td>1978</td>
<td>Automatic Rice Mill (2)</td>
<td>9600 TPY</td>
<td>49.3</td>
<td>51</td>
<td>16.9b</td>
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</table>

(Continued)
Rice Processing in Bangladesh

(Table 1 Continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>Av. Annual rate of return on capital %</th>
<th>Capacity utilisation assumed</th>
<th>Employment</th>
<th>Labour costs as % capital costs</th>
<th>Labour costs as % total processing costs (minus raw material cost)</th>
<th>Capital cost per job Tk.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skilled</td>
<td>Unskilled</td>
<td>Skilled</td>
<td>Unskilled</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>100</td>
<td>16</td>
<td>34</td>
<td>5</td>
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<td>2</td>
<td>35</td>
<td>80</td>
<td>10</td>
<td>15</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>80</td>
<td>10</td>
<td>11</td>
<td>7</td>
<td>57</td>
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<tr>
<td>4</td>
<td>31</td>
<td>70</td>
<td>31</td>
<td>48</td>
<td>0.6</td>
<td>14</td>
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<tr>
<td>5</td>
<td>c</td>
<td>67</td>
<td>29</td>
<td>49</td>
<td>7</td>
<td>39</td>
</tr>
<tr>
<td>6</td>
<td>21</td>
<td>50</td>
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<td>18</td>
<td>0.9</td>
<td>15</td>
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<tr>
<td>7</td>
<td>25</td>
<td>50</td>
<td>12</td>
<td>12</td>
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<td>31</td>
<td>80</td>
<td>18</td>
<td>22</td>
<td>0.2</td>
<td>11</td>
</tr>
</tbody>
</table>

a Costs for one mill.
b Without paddy costs.
c Not calculable.
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REFERENCES


APPENDIX A

Realistic Projects: 21 Questions to Consider When Designing or Appraising Post Harvest Processing Proposals

1. Is there a need? What is the magnitude of marketed surplus (not production by itself)? Are there many or few paddy varieties likely to be involved? What are the ranges of moisture and quality likely to be encountered?

2. Existing Facilities: Existing installed capacities, locations, capacity utilization and costs of processing.

3. Location: This is affected by existing capacity, the capacity proposed, the distribution of surplus, the distribution of final markets and transport costs.

4. Transport: Is it costed? How organised? Is the type of transport appropriate for the real communications network?

5. Storage: Is it adequate? How does it relate to Government storage regulations? Are handling and storage costs mentioned? Is interest on capital included?

6. Working capital: Is it adequate for processing and storage?

7. Appropriateness: Does the machinery match local resources? e.g., husk as a fuel; transport and conveying equipment; local rather than foreign manufacture possible?

8. What assumptions are made about the size and the time distribution of the foreign exchange component? Specify the speed of movement of spares for each imported machine and state the capacity utilization at which these assumptions are made.
9. What assumptions are made about quantities and prices of oil, kerosene and grease?

10. Outturn of rice from paddy: What is the basis? What is the range with different types of paddy (short grain/long grain etc.) at different levels of polish? What assumptions are made about existing outturn in the country?

11. What capacity utilisation is assumed in costing? (50-60 per cent is realistic).

12. Management: How are mill administrators to gain experience? What new skills are necessary?

13. Unskilled labour: On what basis are the numbers and costs of unskilled labourers calculated?

14. Employment: How could employment using this technology be increased? What would be the disadvantages and advantages of increasing it?

15. By Products: On what assumptions about outturn and price are revenues from by-products calculated?

16. The Market for Rice: Where will rice go? What is the basis for the prices assumed over the life of the project? Is the final product appropriate in terms of quality for the market or is it over-specified?

17. Food Policy: How much does the business of the proposal rely on Government procurement? Is there an assurance from the Food Department of business in cases which assume contract milling?

18. Changes in business ownership: What would be the effects of changes such as from contract milling to free market trading?

19. Flexibility: How flexible is the technology to changes in processing e.g. parboiled or raw rice - specify costs. How sensitive are profits to changes in the prices of products and by-products?

20. Alternatives: Do you have costs of existing alternatives? If not why not?

21. How reliable are the statistics used? What are their bases for collection? How sensitive is calculation of profitability to guesses?
East Pakistan, Appendix D. Investment Portfolio Brief on Rice Bran oil, pp. 107-116.


Note on Confidentiality:

Every effort has been made by the writer to conceal the identity of proposals stated to be confidential, within the stated objectives of this report: to appraise existing and proposed post harvest processing technologies in Bangladesh.