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An Analysis of Modernization of the Rice Milling Industry in India

By

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AN ANALYSIS OF MODERNIZATION OF THE RICE MILLING INDUSTRY IN INDIA

Summary and Policy Recommendations

This paper discusses the factors that determine efficiency of the rice milling industry. It examines the performance of the traditional rice milling industry during a recent period of free trade. Further, it examines the operation of two modern rice mills from the viewpoint of economic efficiency. It also examines the question of expansion of storage facilities.

The report illustrates that the spread between prices of rice and paddy during the period of free trade was well above technologically determined milling margins. It also points out the considerable year to year fluctuations in the utilization of the effective rice milling capacity. The paper contends that certain governmental policies detracted from efficient operation of the rice milling industry through their effects on choice of technology, on competition and on capacity utilization. It illustrates how policies encouraged expansion of antiquated hullers and discouraged modernization thus raising milling costs and affecting outturn. It also shows that first, policies did not enhance competition, and second, inappropriate policies, or lack of them, reduced utilization of effective capacity through instability of price movements.

The question of modernization centers around the most desirable size of the mills to be established. It is sometimes suggested that due to the high costs of carrying paddy, it may be more desirable to install large rice mills and use them only seasonally. However, examination of modern mills shows that unit fixed costs may be higher in large modern mills as compared to small modern mills even at full capacity utilization of both size of mills. This is due to the higher capital intensity likely to result in large public sector mills compared to small private modern mills. However, even if the large mills are not relatively more capital intensive, if they are used only partially, unit fixed costs are much higher than when small mills are used at full capacity to mill the same amount of paddy.

There is no evidence to suggest that unit variable costs in large mills will be lower than those in small mills for the same quantities of paddy milled. Variable costs in large mills may even be higher due to the higher costs of procurement and higher storage and handling losses in large mills.

The savings in interest on working capital brought about by only a seasonal and partial utilization of capacity of large mills may thus be more than compensated by their high unit costs. It, therefore, seems particularly desirable to establish small modern mills and utilize them close to capacity.

This could be better brought about by modernization of existing private mills, so as to minimize the costs of modernization and hence costs of processing. This will help maintain a high degree of capacity utilization, a high degree of competition between mills and maximize the benefits of the existing market infra-structure in channeling the marketable surplus. Apart from meeting the processing requirements of the buffer stocks of the Food Corporation of India, any additional investment in modern mills in the cooperative and public sector should be undertaken purely on a cost-benefit basis.

The examination of storage problem suggests that despite the economic superiority of silos over flat warehouses in a narrow cost accounting sense, expansion of flat warehouses may be more desirable. Due to their divisible nature and multiple use, flat storage warehouses are more likely to be constructed in the private sector than silos. This will accelerate the growth of the warehousing facilities so essential for handling increased marketable surplus, as well as assuring high utilization of invested capital.

The following policies thus seem desirable for an efficient performance of the rice milling industry. First, a favorable atmosphere needs to be created which would encourage private investment in technologically superior milling equipment. Second, a need for extension of technical knowledge ought to be recognized and a positive program adopted for making millers in the private sector aware of modern milling technology. Third, credit should be made available to millers for modernizing existing rice mills so as to foster competition between those who can raise their own capital and those who for lack of capital would fail to modernize. Four, a facilitative rather than inhibitive price policy which would stabilize off-seasonal price movements and market supplies from year to year would considerably reduce rather than increase uncertainty in the trading operations thereby increasing utilization of effective milling capacity and thus decreasing average costs and increasing competition.

Policies need to be adopted for improvement and expansion of flat warehouses in the private sector which would meet certain minimum scientific standards.

ANALYSIS OF MODERNIZATION OF THE RICE MILLING INDUSTRY IN INDIA

Uma J. Lele

Cornell University

Introduction

Considerable attention has recently centered in India on the question of modernization of the rice milling industry. The observations made by a Ford Foundation Team aptly summarized the maladies of the traditional rice milling industry.

1. The paddy received from farmers is low in milling quality.

2. Traditional storage in India does not provide adequate protection.

3. Milling machinery manufactured in India was designed 30 to 50 years ago. Most of this machinery consists of hullers which give rice outturn of 64 percent. The remaining is sheller type which gives an outturn of 68 percent.[1]

The team, therefore, recommended an over-all modernization of the paddy-rice system beginning from improved production practices by cultivators to establishment of mechanical driers, rubber roll sheller mills and bran extraction plants coupled with improved storage facilities at all levels of handling. The team observed: "For each of the modern storage and milling facilities, the expected increase in outturn of rice would save 1,600 tons of rice a year. This additional outturn would have an estimated value of Rs. 11 lakha. The proposed modern storage and rice milling facilities will operate at a lower cost than mills currently in use."[2] Upon recommendations of the Ford Foundation team, the Food Department made a decision in July 1964 to set up seven imported modern rice mills as the first step toward modernization. Six mills were set up in the cooperative sector and one in the public sector. The Food Corporation of India subsequently undertook establishment of 25 Japanese modern rice mills financed by a yen credit. The Fourth Five Year Plan Proposals called for establishment of over 300 modern mills in the public and cooperative sectors.[3] This is expected to create a capacity to mill 8.5 million tons by the end of the Fourth Plan.

Although the role of the private sector in modernization remained obscure in the initial stages, commercial banks have now been given directives to advance loans to private millers up to as much as 90 percent of the cost of modernization so as to accelerate replacement

of traditional hullers and underdisc runners by rubber roll shellers in the private sector.

Three indigeneous firms have entered into collaboration with Satake and Kyowa of Japan and Schule of Germany for manufacturing modern rice milling machinery in India. The first indigeneously manufactured milling machinery has already been off the assembly lines for some time. A research and training center has been established at the Indian Institute of Technology, Kharagpur.

Modernization policies and programs have thus made considerable strides. A rapid pace of modernization and subsequent efficient operation of the rice milling industry is, however, not necessarily assured by the present policies and programs.

This paper discusses the factors that determine efficiency of the rice milling industry. It then examines the performance of the traditional rice milling industry during a recent period of free trade. It illustrates how performance of the existing milling industry can be evaluated in terms of the efficiency criteria outlined. Further, it examines the recent modernization policies and programs also in terms of the efficiency criteria outlined.

It is the contention of this paper that various governmental policies detracted from efficient operation of the rice milling industry through their effects on choice of technology, on competition and on capacity utilization. The paper then examines the implications of the industry's past performance, and of its recent modernization policies, for the efficiency of the milling industry in the future.

Factors Affecting Efficiency

Efficiency of the rice milling industry may be affected by the following factors: technology, rate of capacity utilization, fluctuations or steadiness in capacity utilization, degree of competition or monopoly, size of the milling plants, geographical concentration or spread, vertical combination and private or other ownership of the firms.

Technology through its effect on costs of conversion and quantity and quality of rice and by-products produced affects the margin between paddy and rice prices. It thus determines the floor to the paddy rice margins. Less than full capacity utilization raises costs and may widen margins. Variation in capacity utilization from year to year may considerably determine the pricing policy of the mills in an individual year. Degree of competition has a considerable effect on the margins over and above the technologically determined margins between paddy and rice prices. Thus given a competitive framework and full capacity utilization, paddy-rice margins may be almost completely determined by the milling technology. These various factors

are, however, not mutually exclusive and almost always interact thus complicating the problem of distinguishing the effects of one from the other. For example, technology may dictate the size of individual firms thus affecting degree of competition and capacity utilization. On the other hand, governmental policies may enforce firm size which in turn may limit the choice of technology, affect capacity utilization, and influence geographical location all of which have implications for degree of competition. However, even in a competitive industry capacity utilization may vary considerably from one year to another thus affecting milling costs and hence margins.

In a perfectly competitive market, rice and paddy prices in an individual market on any particular day should bear the following relationship:

> Price of one quintal of rice = price of paddy equivalent of rice + costs of milling the paddy equivalent - value of by-products - the value of the quality differential in milling.

It must be emphasized that relationship between paddy and rice prices may also be affected by movements over space and time, in which case transport, storage and handling costs must be considered. We are isolating from these factors which have been analyzed elsewhere[3a] and which show margins generally commensurate with costs. Here we are strictly concerned with returns to milling as distinguished from those to shipping and storage.

We will briefly discuss the effect of the various components on paddy rice margins in general and then proceed to examine the actual behavior of the paddy-rice prices within a market in any week during the period of free trade through the effect of these factors on efficiency of paddy rice system.

1. Milling Technology

Milling technology determines the milling outturn and hence the paddy equivalent of rice. Certeris paribus, the larger the milling outturn the smaller the price spread between rice and its paddy equivalent. The Central Food Technological Research Institute's findings show that in the case of parboiled rice, modern rice mills yield on an average 0.8 percent more rice over underdisc runner shellers and 1.6 percent over hullers. In the case of raw rice, the outturn in modern mills is 2.5 percent higher than traditional shellers and 6.6 percent higher than hullers.[4]

Milling Costs: Costs of milling paddy consist of the direct costs that vary with the quantities of paddy milled and the fixed costs. Both the direct variable costs and fixed costs vary considerably in different milling technologies. Fixed costs may, however, also vary between mills using the same technology.

Variable costs in traditional huller mills, excluding the cost of paddy itself, consist mostly of the labor required for parboiling, drying and moving paddy and for bagging rice. The data collected from selected modern rice mills and traditional huller mills point out the significant difference in the labor intensity of the two milling

technologies.[5] The other variable costs such as fuel and electricity are much more substantial in modern mills due to greater automation.

Fixed costs consist of depreciation and maintenance, salaries of permanent employees, taxes, license fees and other establishment costs. Depreciation may vary considerably according to the age of the milling machinery even between two mills using the same technology.

Due to the relatively higher capital intensity of the modern mills, depreciation constitutes a much more significant component in modern rice mills as compared to their traditional counterparts. This has important implications to unit fixed costs likely to ensue under the two technologies at different levels of capacity utilization. Our data show a significant variation in unit fixed costs for different levels of capacity utilization in modern rice mills.[6] Other costs such as wages take on the form of salaries of permanent employees in modern mills, are higher and are also likely to vary much more significantly at different levels of capacity utilization in modern rice mills due to the higher management component. The absolute level of fixed costs and hence the variation according to capacity utilization are relatively much less significant in traditional hullers.

Value of By-Products: Value of by-products is determined by the quantity and quality of by-products produced by the different milling technologies. In the traditional huller, bran is usually mixed with powdered husk and not separated. Millers sometimes sell this so-called bran as cattle feed. They use the husk as fuel in mills. In modern rice mills, 4 percent bran can be obtained in unadulterated form. The price of bran obtained from traditional hullers ranged from Rs. 20.00 to Rs. 30.00 per ton in 1969. The bran produced in modern rice mills fetched Rs. 400/ to Rs. 450/ per ton. By-products thus would have significant implications for size of margins in different technologies.

Quality of the Milled Rice: Central Food Technological Research Institute's evaluation indicates that for raw paddy, increases in head rice yield, defined as all grain of 3/4 size or larger, in the modern mills over sheller mills varied from 1.0 percent to 12.4 percent with an average increase of 6.1 percent.[7] As compared to huller mills, the corresponding increases varied from 6.5 percent to 27.7 percent with an average of 15.1 percent.[8] For parboiled paddy, the corresponding increases over sheller units varied from zero to 1.5 percent with an average of 1.3 percent. The increases over huller mills varied from 1.0 to 8.5 percent with an average of 4.1 percent.[9] Rubber roll sheller mills are thus obviously much superior in quality of processing to traditional hullers and even to traditional sheller mills.

Considerable difference of opinion exists in India and other rice-consuming countries in Asia as to whether quality differences would gain significant price differentials. The underlying contention

is that consumers in Asia do not show a marked preference for higher head rice content and that, in fact, in some cases, there is a special demand for broken rice due to traditional preparations made out of such rice. Due to an absence of a free market in rice in India since establishment of modern rice mills little can be said about quality differentials in rice prices. Price differences due to quality should be distinguished from those due to varieties for which we have abundant evidence from the past.[10] An interesting study made of the domestic rice market in the Philippines indicates that price differences due to quality are much smaller in the domestic market in the Philippines as compared to those in the international market.[11]

The excessive emphasis on improvement in physical characteristics of rice processed in modern mills has been mainly due to the importance given by American consultants in the initial stages in India and elsewhere in Asia to the appallingly poor quality of domestic processing when compared with the standards of the international trade. The point, no doubt, is particularly relevant in countries such as Pakistan that have been unable to compete in the international market due to poor processing methods. In the domestic markets of Asia, however, investment in modern mills seems much more justifiable on the grounds of increased outturn and improved by-products both of which by themselves provide enough economic justification for investment.[12]

Milling technology thus has different effects on the various components discussed above and hence may provide quite different levels of market margins that may be justified under competitive conditions.

2. Rate of Capacity Utilization and its Stability

The degree to which the full engineering capacity of a rice mill is used would depend on a host of factors including, availability of paddy, expected and actual prices of paddy and rice, cost and availability of credit and other costs of storing paddy. Thus when there is only a single major harvest of paddy, a major portion of the supplies may have to be purchased in the immediate post-harvest period to be able to keep mills running all through the year. The carrying costs of paddy will, therefore, have significant effect on capacity utilization. Prices of paddy, expected and actual, may considerably affect the quantities purchased and the timing of purchases. This in turn will affect capacity utilization of rice mills. We will discuss the implications of price factors for capacity utilization. We will also examine the effect of utilization on milling costs in the short run and on allocation of capital to milling in the long run.

Capacity utilization may vary significantly from year to year depending, among other things, on availability of paddy, cost of paddy purchases and price expectations. We will illustrate with evidence the effect of these factors on stability of capacity utilization.

3. Degree of Competitiveness

Where different milling technologies exist simultaneously, the price of rice may be determined by the technology of the marginal producer if the market operates competitively. The producers using more efficient technology will earn profits larger than "normal," much in the nature of "rent," thereby encouraging a shift toward a more efficient milling technology. When considerable expansion takes place of the low cost technologies, any excess capacity that may exist in this milling sector may result in undercutting prices, so that the process of elimination of inefficient milling technologies is accelerated not so much due to the profit incentive, but due to the loss involved in not shifting to more efficient milling technology. The shift from handpounding to hulling is an excellent example of such economic forces at work in the processing system in the past.

4. Size of the Individual Firms

If markets were left to themselves, in the long run, the shape of the average cost curve may have a significant effect on the size of the rice mills and hence on the degree of capacity utilization. Milling technologies have a significant effect on the shape of the average cost curves. Thus the more inelastic the average cost curve with respect to change in the quantities milled the larger the size of the plant likely to be adopted and the lower the capacity utilization. If the costs of underutilization are fairly low millers may prefer to establish large mills so as to maintain a flexibility in the size of their milling operations.

When markets are, however, not left to themselves but guided by government policies, size of the plants may be influenced by what are expected to be the average costs. We will illustrate that official cost estimates often do not consider such crucial factors as the relationship of purchase price and procurement costs to the volume of stocks acquired and hence their effects on average costs. But more important, official estimates often disregard the variations in costs likely to occur at different levels of capacity. Both these factors may have a significant effect on size of mills adopted, costs of milling and hence margins likely to ensue.

5. Geographical Concentration or Spread

Several gains may accrue from the grographical concentration of firms, some in bargaining, buying or selling, some chiefly from the volume of output in a given area and some chiefly from the number of competitors in an area. The gains also include external economies likely to accrue from improved transport, communications and market intelligence facilities as distinct from internal economies of the firm size.

6. Vertical Combination

Considerable economies may also result from conbining rice milling with bran extraction plants. This will, however, depend on the costs of individual plants and the volume of paddy that can be handled economically.

7. Private Versus Other Ownership

Variations in efficiency may result from management decisions regarding purchase and stocking of paddy and sale of rice. It is likely that managing practices differ significantly between millers in the private, cooperative and government sectors. However, ownership may also have implications for degree of capitalization and hence operational costs of individual firms.

In Part I, we will discuss the effect of these various factors on the performance of the traditional milling industry. In Part II, we will examine the performance of the modern rice mills in terms of these factors. In Part III, we will discuss the storage question.

Part I

Efficiency of the Traditional Milling Industry

It is of interest to examine whether the rice milling industry operated efficiently when considered in terms of the milling margins set by the traditional technology. The actual spread between paddy and rice prices in Tamil Nadu and West Bengal during 1955-56 and 1963-64 are, therefore, compared below with the milling margins hypothesized to exist under conditions of traditional technology and perfect competition. The following assumptions are used for estimating the various components of milling margins.

Actual Milling Outturn

For the comparison of rice and paddy prices, a ratio of 2:3 is used as the outturn of rice from parboiled paddy. This is in conformity with the outturn from parboiled paddy estimated in most standard government publications of the central and state governments and is consistent with the recent findings of the Central Food Technological Research Institute regarding milling outturns from parboiled paddy in huller mills.

In West Bengal all the paddy is parboiled before milling. In Tamil Nadu almost all the medium and coarse paddy is parboiled. A major portion of the fine paddy is also parboiled. Consumption of raw rice is usually reserved for special religious ceremonies and confined to some specific communities.

Actual Milling Costs

Since almost all the marketed surplus for this period was milled in traditional hullers, milling costs are considered only for huller mills. Existing secondary data on milling costs have several drawbacks. First, they are often outdated and refer to the prewar and early postwar period. Second, they show considerable diversity in costs even for the same types of milling equipment. This is particularly true of data for West Bengal. Third, they show considerably higher milling costs for West Bengal than for other states. Since, secondary estimates almost never specify what components of costs are included, it is not known whether this is due to differences in definitions or whether costs are, in fact, so high.

Milling costs allowed by various state governments under their procurement programs also show considerably higher milling costs for West Bengal and probably are not indicative of the actual milling costs. Unlike Andhra Pradesh, Tamil Nadu and Maharashtra that allowed Rs. 1.50 per quintal of paddy milled (i.e., Rs. 2.25 per quintal of rice) as milling charges in 1967, the West Bengal government allowed

Rs. 5.30 per quintal of rice. The Tamil Nadu Government subsequently reduced this to Rs. 1.00 per quintal of paddy milled or Rs. 1.50 per quintal of rice. The West Bengal Government also reduced the rate to Rs. 4.70 per quintal of rice. In addition both the governments pay for procurement costs, procurement commission and incidentals. In Tamil Nadu, the government paid Rs. 3.25 per quintal of rice to cover these various charges. Thus the government paid Rs. 4.75 per quintal of rice delivered in Tamil Nadu. As against this, the Food Corporation in West Bengal paid Rs. 7.13 per quintal of rice delivered. In both the states extra payments were made for gunnies. These were more or less comparable with each other.[13]

Because of the variation in costs shown by these other sources we used milling data collected through our own surveys in Tamil Nadu and West Bengal. Our investigations show a remarkable degree of uniformity in the variable costs of milling in Tamil Nadu. The direct milling costs that consist of labor costs and costs of oil and fuel ranged between Rs. 1.00 and Rs. 2.00 per quintal of rice. Fixed costs vary somewhat more, due entirely to variation in the depreciation component. Our data for Tamil Nadu show average total cost of milling to be Rs. 5.50 to Rs. 6.00 per quintal of rice in 1969.[14]

In order to examine whether actual milling costs were in fact higher in West Bengal than in Tamil Nadu or whether some other elements caused milling costs to be so high, we also collected data on milling costs directly from selected rice mills of various sizes in West Bengal. Our data for West Bengal show that the direct costs of milling which include oil, fuel, electricity and salaries of temporary workers range between Rs. 1.50 to Rs. 4.00 per quintal of rice as against Rs. 1.00 to Rs. 2.00 in Tamil Nadu. On the contrary the fixed costs of operation defined to include depreciation, interest on block capital, insurance, maintenance and salaries of permanent employees, range only between Rs. 1.0 to Rs. 2.75 per quintal of rice.[15] The average total milling costs per quintal of rice for 1968 show a range of Rs. 2.70 to Rs. 5.10 in West Bengal.[16] The costs show no consistent variation according to the size of the plant.

The total milling costs per unit, therefore, do not seem to have been higher in West Bengal. It is however, noteworthy that mills in West Bengal show considerable variation in variable costs of milling. Various reasons seem plausible. In 1968-69 mills were milling paddy for the West Bengal government. Records of some mills show operations much below capacity. If the low level of operation was unexpected this must have affected the millers' hiring of labor and hence costs. However, a less generous view of the situation would suggest that some millers milled more paddy than their records indicate and assigned all their variable costs only to the stocks submitted to the government. Our data show that there was a substantial decline in the reported quantities of paddy milled by rice millers in West Bengal during periods of control while the supplies in fact found their way to the consuming markets, although in part through single hullers.

The third possible explanation for such a substantial variability in variable costs may be that some mills are simply more inefficient in their operations than others and do not really have to attempt to reduce their costs due to the high milling rate allowed by the state government as compared to any other state in India. On the contrary, pressure from the millers for maintaining such high milling rate may be the result of such inefficiencies on part of some millers while the efficient millers reap profits from high milling rates. The fourth likely explanation is that due to controls other components such as bribes to government officials, and heavy storage losses due to clandestine storages, which normally do not enter economic calculations raise milling costs from some millers.

Whatever the reasons, our data from Tamil Nadu and West Bengal suggest that millers in West Bengal have been paid adequately to cover fixed and variable costs of processing. On the contrary, the Tamil Nadu Government obviously seems to have paid too little to its millers for milling when the official milling rates are compared with our milling cost estimates. Either policy is likely to encourage inefficiency. The case of high milling charges needs no further laboring. When milling rates are so low as in the case of Tamil Nadu, there is also likely to be a considerable pressure on millers to recover costs through devious means. It is of interest to know how well the actual spread between paddy and rice prices corresponded with milling costs in a free market.

On the basis of our total average milling cost of Rs. 5.50 or 6.00 per quintal of rice for Tamil Nadu in 1969 we have assumed total milling cost to be Rs. 5.00 per quintal of rice during 1955-56 to 1963-64. Although millers indicated that milling costs have nearly doubled since 1963 (see footnote 14), we have made a lesser discount, so as to allow for a reasonable return to the miller for his milling operations. There was no significant increase in milling costs from 1955-56 to 1963-64. Therefore, only a single estimate of Rs. 5.00 is assumed to have been applicable to the whole period under consideration.

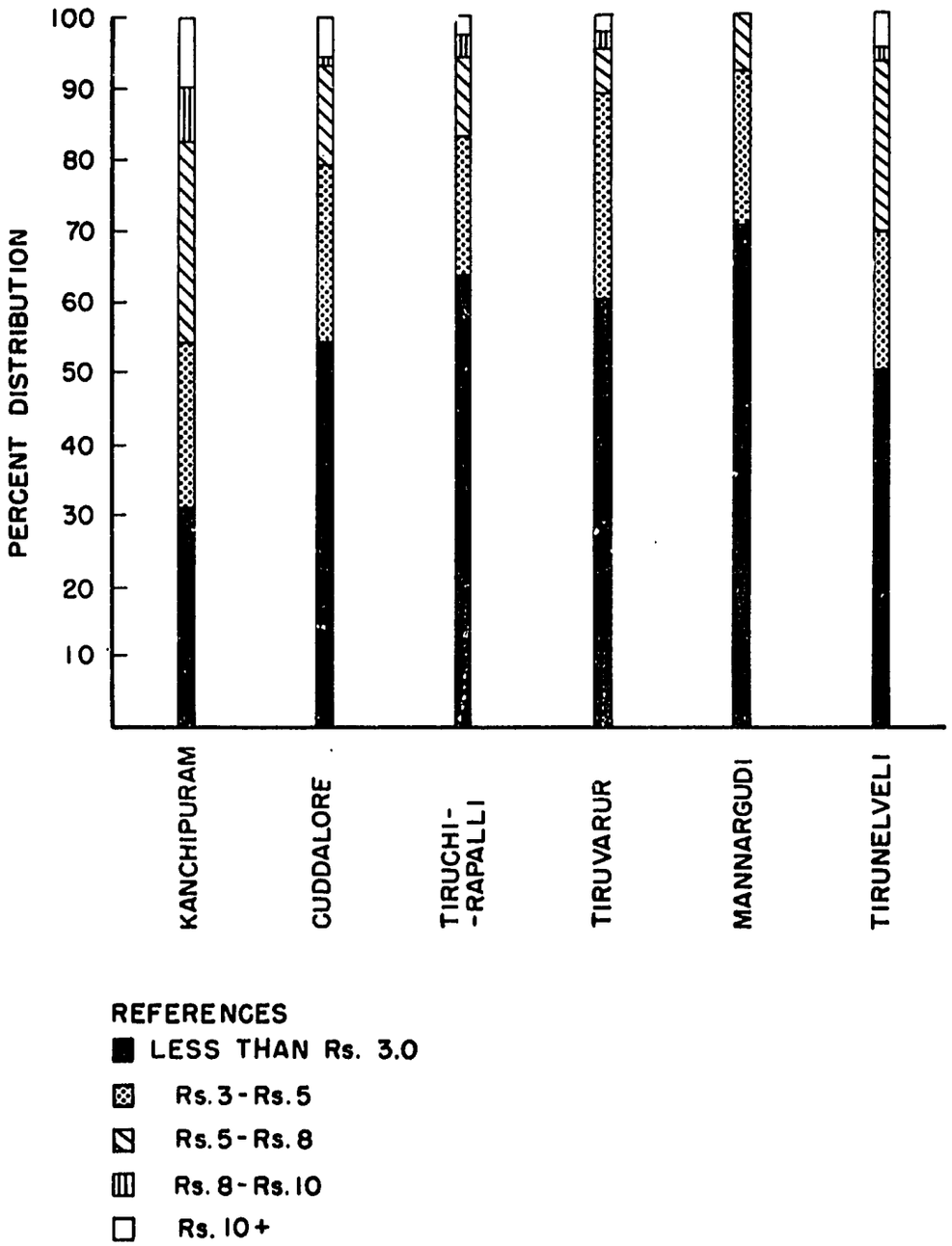
Price differences due to differences in the quality of rice and value of by-products were ignored since our analysis is confined only to parboiled paddy milled in hullers.

Thus during the period of free trade, rice prices were expected to have been equal to (1.5) times the price of paddy + Rs. 5.00.

Actual Margins Between Paddy-Rice Prices in West Bengal and Tamil Nadu

Weekly wholesale prices and their paddy equivalents of rice within single markets for the period 1955-56 to 1963-64 were compared in several primary markets in West Bengal and Tamil Nadu.[17] In Kanchipuram out of 434 weeks, as much as half the times the price difference was above Rs. 5.00 per quintal of rice and as much as 28 percent of the times above Rs. 8 per quintal. In Tirunelveli price difference was above Rs. 5.00, 31 percent of the time of which 7 percent of the time it was above Rs.8.00. In Cuddalore the difference was 21 percent of the time above Rs. 5.00 of which 7 percent of the time it was above Rs. 8.00. In Tiruchirapelli the difference was above Rs. 5.00 17 percent of the time, of which 5 percent of the time it was above

Figure 1. Percentage Distribution of Difference Between the Price of One Quintal of Rice and 1.5 Quintals of Paddy, Primary Markets, Tamil Nadu, 1955-1963.



Rs. 8.00. In Tiruvarur the difference was above Rs. 5.00 only 11 percent of the time, and in Mannargudi 8 percent of the time. (Figure 1).

The examination of the paddy-rice prices in West Bengal shows a much larger spread in the West Bengal markets than in Tamil Nadu (Figure 2). In Burdwan, the spread remained above Rs. 5.0 88 percent of the time of which it was above Rs. 8.00 23 percent of the time, in Guskara 87 percent of the time of which 27 percent above Rs. 8.00, in Sainthia 77 percent of which 33 percent of the time above Rs. 8.00 and in Bolpur 34 percent of the time of which 8 percent of the time above Rs. 8.00. The evidence thus shows that the milling industry did not operate efficiently even within the technological confines and that considerable scope existed for excess profits.[17a] The lower percentage in Bolpur may have been due to the poor transport facilities in Bolpur which probably kept rice prices depressed as compared to other nearby markets. The generally larger spread in West Bengal may partly have been due to the fact that paddy brought to the market usually has a much higher rate of refraction (i.e., dust and foreign matter) as compared to other states, where cultivators clean paddy before marketing it. This was consistently noted in discussions with procurement officials in West Bengal and Tamil Nadu. However, the refraction rate is by no means adequate to explain such high margins. The larger spread in Bengal is also commensurate with the higher milling costs claimed to exist in West Bengal. These factors, however, do not completely explain the high market margins in the two states.

Some Plausible Causes of Inefficiency

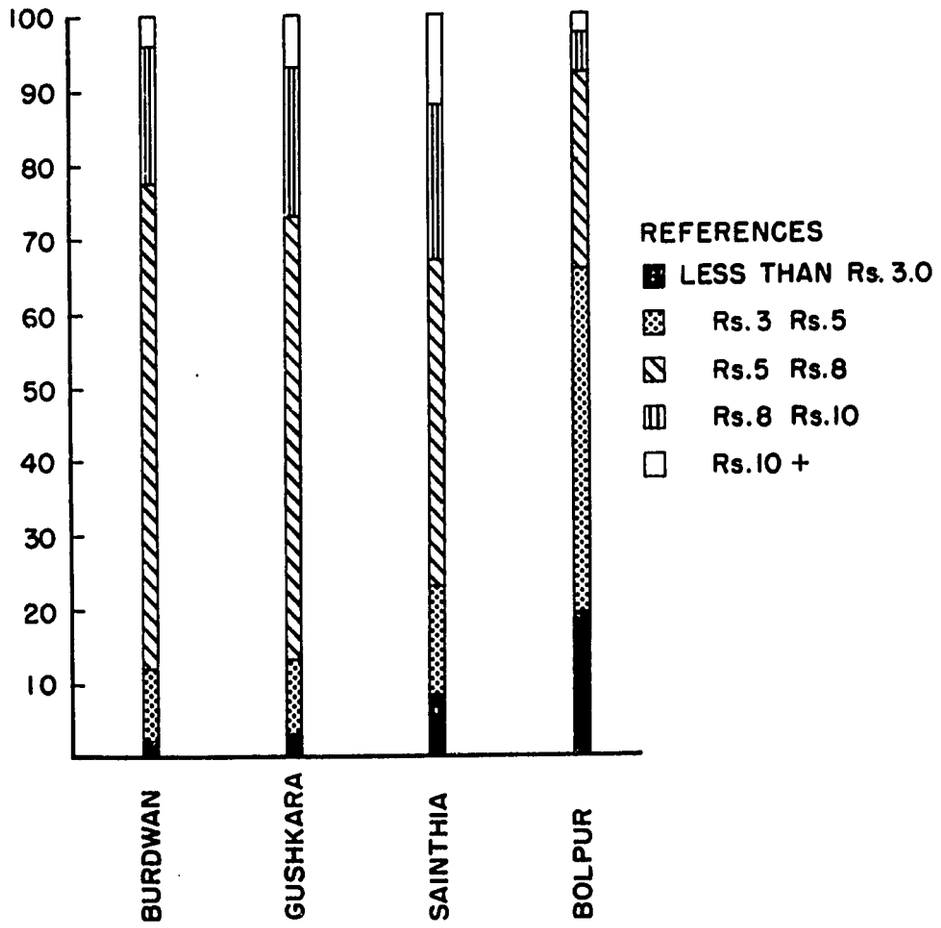
A further examination of the operation of the rice milling industry during the period of free trade and after shows several interesting features of the competitiveness of the system that have a direct bearing on the level of margins between paddy-rice prices.

Capacity Utilization

When rice mills are divided into the organized and the unorganized sector, data both for West Bengal and Tamil Nadu show that a major expansion of the rice milling industry was brought about by an increase in single hullers. These have been most significant in replacing handpounding of paddy used for domestic consumption but not in providing competition to the organized rice mills. We illustrate this below on the basis of the evidence on number of rice mills in the organized sector, their effective capacity and the quantities of paddy milled during the period under consideration. Briefly, they indicate that utilization of effective capacity in the organized sector was not as low as generally believed to be true. The data also suggest that there was no declining trend in the capacity utilization of rice mills in the organized sector until 1965.

Number of Rice Mills and Capacity Utilization in the Organized Rice Mills, West Bengal: The rice milling industry is comprised of two sectors: the organized sector in which the millers purchase paddy on their own account, and the unorganized sector in which milling is done

Figure 2. Percentage Distribution of Difference Between the Price of One Quintal of Rice and 1.5 Quintals of Paddy, Primary Markets, West Bengal, 1955-1963.



on a custom basis. Although there is an overlap of functions in the two sectors, mills in the unorganized sector are generally single hullers. Thus it is possible and convenient to maintain a distinction between the two sectors.

The published official statistics on the number of licensed rice mills in West Bengal (defined as excluding single hullers) suggest a considerable increase in their numbers despite the restriction of the 1958 Rice Milling Industries Act.[18] The statistical abstract of the government of West Bengal for the year 1962 indicates that there were 293 licensed rice mills in 1953 and that the number increased to 494 in 1960 and to 515 in 1962. The records of the Food Department for later years show 729 licensed rice mills in 1967 and 741 in 1969.

This increase is confirmed by the estimates of the Annual Survey of Industries conducted by the Central Statistical Organization. Due to changes in the definition of a factory, these are not comparable over a long period of time. However, data for 1960-1964 period show that rice mills employing 50 or more workers with the aid of power increased from 135 in 1960 to 185 in 1962 and to 212 in 1964.[19] However, there is some question about the interpretation of these data, since inquiries with the Food Department of the government of West Bengal indicate that due to the 1958 Act, not many new rice mills are likely to have been established in the private sector in West Bengal since the mid 1950's.

No information is available on actual capacity of the rice mills or their capacity utilization. Data collected by the Food Department show the total quantity of paddy milled by rice mills in the state between 1960 and 1969. From these data, it should be possible to estimate capacity utilization of rice mills over time if some assumptions are made about their actual capacity. However, these data have several limitations. Quantities of paddy milled are estimated from the weekly returns that millers were required to submit of their purchase, milling and stock operations, under the 1958 Rice Milling Act. Since the purpose of the returns was to judge the stocks of paddy with traders so as to formulate a procurement and distribution policy, millers almost always understated the quantities of paddy purchased and milled so as to avoid seizure of stocks. Understatement became even more pronounced after 1965 when the government imposed a levy on millers which often consisted of 100 percent of the quantities milled.

An alternative estimate of capacity utilization can be derived from assumptions about the average size of mills and the percentage of the marketed surplus milled in the organized rice mills. Such estimates were made on the basis of the information collected from the Food Department, interviews with rice millers, and the East India Rice Millers' Association.

Table 1 shows the estimates, based on official data, of quantities of paddy milled and those based on hypothetical assumptions outlined above.

Table 1. Number of licensed rice mills in the organized sector and estimates of effective capacity utilization, West Bengal, 1955-1969.

Year	No. of rice mills	Estimated effective capacity of rice mills[1] (in rice)	Our estimates of quantities of rice milled[2]	Our estimates of utilization of effective capacity	Official estimates of quantities of rice milled	Official estimates of utilization of effective capacity
1	2	3	4	5 = 4/3	6	7 = 6/3
		000 metric tons		percent	000 metric tons	percent
1955	360	900	765	85	N.A.	N.A.
1956	391	977	836	86	N.A.	N.A.
1957	425	1062	940	88	N.A.	N.A.
1958	446	1115	860	77	N.A.	N.A.
1959	467	1167	851	73	N.A.	N.A.
1960	494	1235	857	69	650	53
1961	497	1243	1067	86	810	65
1962	515	1288	963	75	790	61
1963	N.A.	N.A.	899	N.A.	710	N.A.
1964	N.A.	N.A.	1088	N.A.	700	N.A.
1965	711	1778	1126	63	510	29
1966	N.A.	N.A.	990	N.A.	450	N.A.
1967	729	1823	980	53	150	8
1968	741	1853	1005	54	310	17
1969	742	1855	N.A.	N.A.	350	19

[1]Based on average 10 metric tons of milled rice in a single shift of 8 hours and 250 days of running in a year.

[2]Calculated at 20 percent of the state's production.

N.A. = data not available.

The hypothetical estimates show a higher rate of capacity utilization than obtained from the official estimates. Both of the estimates of capacity utilization show a declining trend which began in 1965. This seems to be due to various reasons. First, a considerable drop in production resulted in lower marketed surplus even assuming a fixed percentage of production. Second, a further decline in supplies to the organized sector was caused by low procurement prices fixed by the government which diverted market supplies away from the regular market channels to single hullers.[20] The cultivators found it profitable to sell rice in the open market rather than sell paddy to rice millers at

procurement prices. Operators of single hullers also indulged in clandestine trade. Third, there was considerable under-reporting by rice millers of quantities milled. The second and third factors explain the much sharper decline in the estimates based on official records of milled rice. During the relatively normal period 1955-1962, capacity utilization seems to have been much higher than is generally believed to be true of organized rice mills in India. Even in that period there was considerable year to year variation in the capacity utilization. The decline in the capacity utilization was thus not a result of genuine competition from single hullers, during normal times. The evidence strongly suggests that intensification of competition in the organized sector was certainly not a saving grace of the mushrooming of hullers.

Number of Rice Mills and Capacity Utilization in the Organized Sector, Tamil Nadu: Data from the Office of the Labour Commissioner, Tamil Nadu, show the number of rice mills with "ten or more workers working... with the aid of power or twenty or more workers working...without the aid of power." Table 2 shows the statistics on these mills in Tamil Nadu from 1955-1966. Data for subsequent years are not comparable because of changes in the definition, and in fact show a considerable decline in numbers in 1967. The Civil Supplies Department provides data on the number of wholesale mills only for 1968. Wholesale mills are equivalent to the organized rice mills that purchase paddy on their own account. The records show the number of mills to be 1,768. The data in Table 2 refer to the organized sector and show a considerable increase in their numbers.

It is noteworthy that the increase in the number of workers is proportionately much smaller than that in the number of rice mills. The smaller increase in the number of workers is by no means due to an increasing trend toward automation, for most of the new rice mills installed were of the traditional huller type. There were only 15 sheller mills and 110 huller-sheller combined type of rice mills in Tamil Nadu in 1964 and the number did not show any significant increase in the subsequent period.[21] Possible explanations for the decline in the average labor force per mill may lie in over-staffing of labor in the earlier years and streamlining of employment in the subsequent period. However, the employment pattern is more likely indicative of a trend toward smaller sized rice mills even in the organized milling sector.

Comprehensive data including small rice mills and single hullers show that in 1960 there were 7,411 rice mills in Tamil Nadu including small rice mills and single hullers. For the period 1964-1968, the number of rice mills shows a substantial increase, most of which comes from a major increase in single hullers (Table 3). Discussions with the Food and Civil Supplies Commissioner corroborate this evidence. New licenses have been issued on the basis of a "need" for more milling capacity in the area. The traditional flows of paddy involved considerable movement of paddy from the surplus areas of South and North Arcot and

Table 2. Number of rice mills with ten or more workers working with the aid of power, Tamil Nadu, 1955-1966.

Year	No. of rice mills	No. of workers
1955	645	10,176
1956	799	11,288
1957	846	12,525
1958	887	13,086
1959	942	12,727
1960	1,011	13,810
1961	997	12,185
1962	1,533	13,702
1963	1,483	14,367
1964	1,463	15,123
1965	1,429	13,428
1966	1,412	12,457

Source: Office of the Labour Commissioner, Tamil Nadu.

Table 3 Number of rice mills, Tamil Nadu, 1964-1968.

Year	Type of rice mill			Total	Annual installed capacity* (million metric tons paddy)
	Huller	Sheller	Huller-Sheller		
1964	8,636	15	110	8,761	6.98
1965	8,818	16	110	8,944	7.26
1966	8,972	14	111	9,097	6.73
1967	9,310	19	113	9,432	7.01
1968	10,000	69	100	10,169	8.89

*Based on one 8-hour shift a day and 250 days of running per year.

Source: Department of Civil Supplies, Government of Tamil Nadu.

Chingleput to Madras, and from Thanjavur to the deficit districts in the western part of Tamil Nadu. There was, therefore, a considerable spread of large rice mills into the deficit districts. Data from the Office of the Labour Commissioner indicate that only a third of the rice mills classified as wholesale mills were located in the four surplus districts of Tamil Nadu. A major portion of the marketed surplus of paddy was processed outside the surplus districts through such large rice mills.

Unfortunately, even less information is available on the average capacity of the large organized rice mills for Tamil Nadu than for West Bengal. Besides, because of a considerable outflow of paddy into Kerala, assuming quantities milled to be equivalent to the total marketed surplus may be less appropriate in case of Tamil Nadu. Thus Tamil Nadu represents only a rough comparison of the total installed milling capacity for the production of paddy for the 1964-1968 period (Table 4). The available data are comprehensive for all mills and show no breakdown between organized and unorganized sectors. There is such a breakdown for 1968 from the Civil Supplies Department's estimate of effective capacity of wholesale mills. If we assume the marketed surplus as 20 percent of the state's production, then capacity utilization for 1968 in the wholesale mills is in remarkable agreement with the over-all estimates for 1968 in Table 4. In periods of free trade, there probably was some outflow of paddy to Kerala, and hence capacity utilization may have been somewhat lower than indicated in Table 4. The evidence nevertheless indicates that effective capacity was used highly in Tamil Nadu.

Although little can be said about relative capacity utilization in the organized and the unorganized sectors, if the trend has in fact been toward smaller rice mills in the organized sector as suggested by data in Table 2, the increase in capacity could not have increased as fast as the number of organized mills. The milling capacity during the period of free trade was probably used relatively more heavily in the organized sector as compared to the unorganized sector. The data for the 1964-1968 period also emphasize the year to year variability in capacity utilization.

Table 4. Effective installed capacity and production of paddy, Tamil Nadu, 1964-1968

Year*	Installed capacity**	Paddy production	Percent utilization of capacity
	(million metric tons)		
1964	6.97	6.00	86
1965	7.26	5.28	72
1966	6.73	5.70	85
1967	7.01	6.17	88
1968	8.89	5.84	66

*Installed capacity refers to calendar years and production year to the July 1 crop year.

**Installed capacity is estimated on the basis of a single 8-hour shift and 250 days of working.

Source: Department of Civil Supplies, Government of Tamil Nadu.

To recapitulate, evidence from West Bengal and Tamil Nadu strongly suggest that even with a considerable increase in the number of milling units, there was no significant decline in capacity utilization of organized rice mills during the period of free trade. Thus there was no increase in pressure on the mills to compete more vigorously and thereby to reduce market margins. It also indicates that lower utilization in the subsequent period was mainly due to governmental policies which diverted market surplus away from the organized milling channels rather than due to the inherent competitiveness of single hullers. There thus was an obvious imbalance in the milling structure as it expanded in size without becoming more competitive.

Types of Milling Capacity: The preceding discussion assumed a specific definition of the rice milling capacity. Effective policy to increase capacity utilization recognizes a wide range of factors affecting capacity utilization. In this context it is useful to distinguish three types of capacity.

Engineering capacity is defined as the highest number of working hours that could be maintained in a year purely on the basis of mechanical feasibility. Although it is hard to specify exactly what this is, customary practice in India suggests that modern rice mills can be run for 300 days a year at approximately 20 to 22 hours of running time a day with the remaining time reserved for maintenance and repairs of the machinery.

Effective capacity is defined as the maximum number of working hours that could be maintained in a year within the confines of technological, social and other physical and environmental restraints. Thus given the family operated nature of the traditional rice milling sector in India, it is reasonable to assume that only a single 8-hour shift will be operated in a day.[22] More important, given the nature of the traditional parboiling process which involves 1-3 days to steep the paddy in boiling water and to sun dry it in open yards, it is more or less impossible to operate rice mills in monsoons where parboiling is prevalent. It is therefore customary to assume 250 days of running time instead of 300 days of running time, as is possible with modern drying equipment. The effective capacity of a rice mill in India is thus slightly less than a third of the engineering capacity of the milling machinery. It is effective capacity which was used in the preceding discussion of utilization of mill capacity.

Optimum capacity is defined as that level of use at which the difference between total revenue and total costs is maximized. Optimum capacity may be much smaller than effective capacity if unit variable costs increase with increases in output, without a corresponding increase in unit revenue. This depends on a variety of factors which we will examine in detail. The extent to which full engineering capacity of the plant is utilized constitutes one of the important factors in industrial efficiency.

Some Hypotheses Regarding Pattern and Extent of Capacity Utilization: The available evidence suggests that in both Tamil Nadu and West Bengal, effective milling capacity in the organized sector was utilized much more heavily than that in the unorganized sector. There was considerable variation in the year to year utilization of effective capacity, dependent on crop size and through the proportion marketed through regulated trade channels.

Price Stability and Capacity Utilization: The most important factor reducing optimum capacity below effective capacity is the cost of providing supplies for the period from one harvest to another. The larger the inter-harvest period and the greater the uncertainty with respect to supply-demand balances, the greater will be the cost and the greater the year to year variation in the percentage of effective capacity utilized.

In years of a small crop, it will be necessary to operate mills at only partial capacity. Where there is only a single major harvest of paddy, cost of raw material increases considerably due to the need for at least partial purchases in the off-season. Such costs are particularly high in periods of sharp seasonal increases. If purchases are restricted to the immediate post-harvest period, stocks required for the full capacity utilization of a rice mill are indeed high and involve considerable working capital. When there is a generally heavy build-up of stocks by the milling sector immediately after the harvest, prices in the off-season do not rise as sharply as otherwise even if production is low.

The evidence on the grain trade operations overwhelmingly shows that traders and millers avoid building up heavy stocks of grain in the immediate post-harvest period and depend considerably on a quick turnover of stocks for profits.[23] This is partly because they depend to a considerable extent on their own resources for working capital. Even when millers desire to borrow funds for the purchase of paddy, there are often considerable restrictions on the availability of bank credit. When credit is available millers have less flexibility in their operations as it is tied to the stocks of paddy.

Perhaps most important in discouraging heavy build-up of stocks by mills in the immediate post-harvest period is the uncertainty of the seasonal price movements that often show excessively high seasonal margins in some years and low margins in others. Although average profit margins over a period of 8 to 10 years may not seem very low *ex post*, the year to year variability in the margins emphasizes the high element of uncertainty implied in storage operations. A large build-up of stocks greatly raises the loss function in a situation of high uncertainty and discourages millers from such a commitment. Capacity utilization is even further discouraged by the government's policies which are generally aimed at curbing stocks as an anti-hoarding measure.

Environmental Restraints and Capacity Utilization: The seasonally low utilization of milling capacity seems to have been even further reinforced in areas where technical restraints on parboiling during monsoons raise costs of carrying stocks beyond monsoons and further reduce effective capacity utilization. The data from modern and traditional rice mills show that even when less than 50 percent of the capacity is utilized variable costs including the price of paddy constitute as much as 96 percent of the total operating costs, with the cost of raw material and interest itself being slightly over 90 percent of the total. Variable costs would constitute even a higher percent of the total costs with increase in the capacity utilization. Where variable costs form such a major portion of total costs decline in average costs as a result of increases in capacity utilization are insignificant and, therefore, do not provide an incentive for extending capacity utilization.

This argument is supported by actual behavior of millers as evidenced by data collected from private rice mills of various sizes in Birbhum and Burdwan districts in West Bengal. It is evident from the data that a close relationship exists between effective milling capacity and storage capacity (Figure 3). The data further show that storage capacity in these private mills never exceeded 60 percent of the annual effective capacity. Further evidence on highly seasonal utilization of capacity is provided by the estimates of monthly production of rice by organized rice mills in West Bengal during 1960 and 1967 (Figure 4). It is noteworthy that data for the eight years covering both free trade and government procurement show a remarkable uniformity in the milling pattern except for a gradual increase in the seasonality of milling in the later years when open private trade and hence seasonal fluctuations in prices were abolished.

Examination of the nature of variable costs of rice mills emphasizes the fact that milling is predominantly a trading operation involving mainly storage and little value added in actual processing. It thus seems highly plausible that the level of utilization at which optimization of profits occurs may change significantly from one year to another according to market conditions. The evidence on capacity utilization when considered in terms of optimization thus seems generally consistent both in terms of absolute level and in terms of year to year fluctuations in the level. This brings forth an interesting distinction between technical capacity, effective capacity and economic capacity of rice mills and emphasizes the need for policies to move the economic optimum as close to the engineering capacity as possible. For an investment pattern which reaches optimum at low levels of engineering capacity although profitable from an individual miller's point of view is obviously inefficient for the society as a whole. For it may result in excessive allocation of society's scarce capital into the milling sector with several intermediaries having to share the function of storage. In the long run the total milling capacity will expand beyond what would be justified under full utilization of engineering capacity.

Figure 3. Effective milling capacity and storage capacity in selected rice mills in West Bengal, 1968.

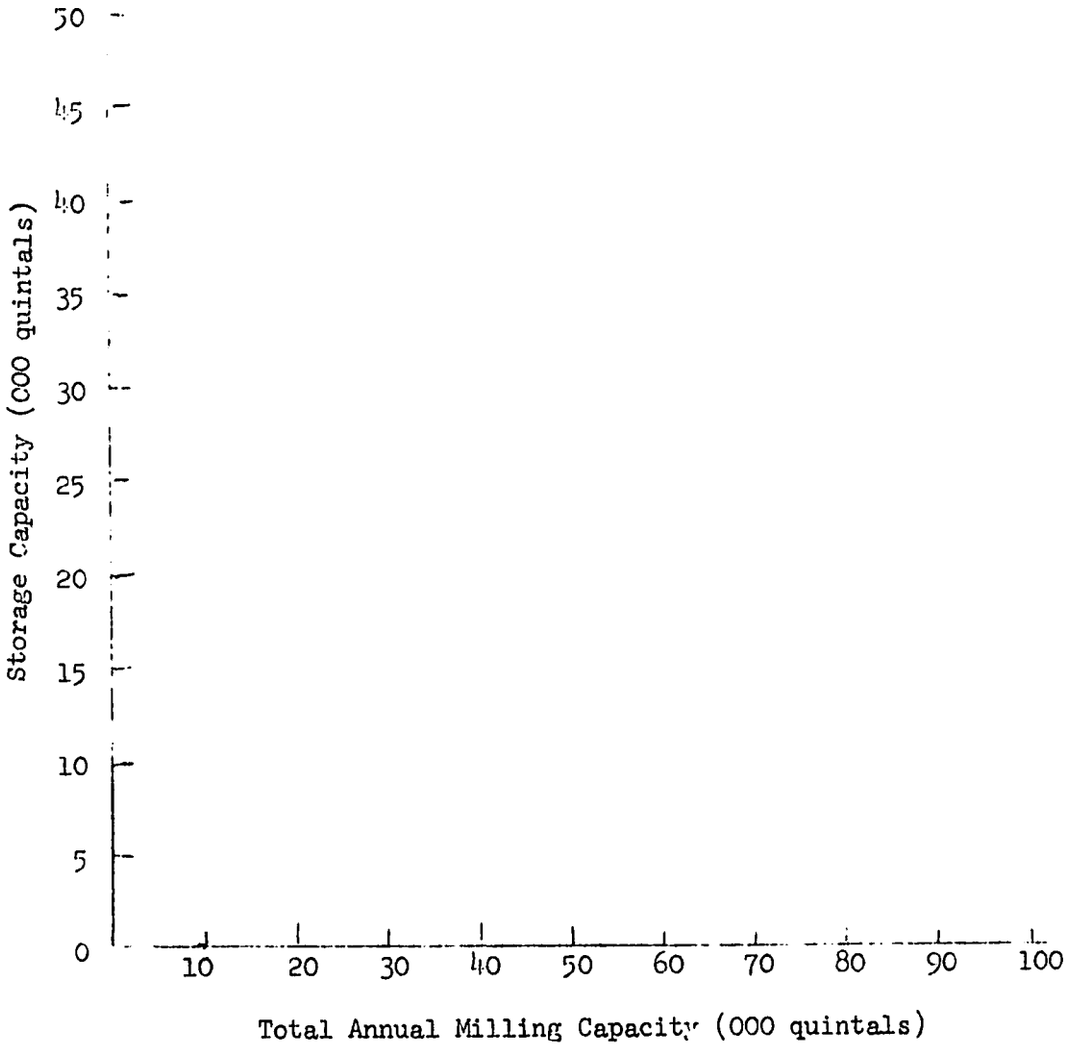
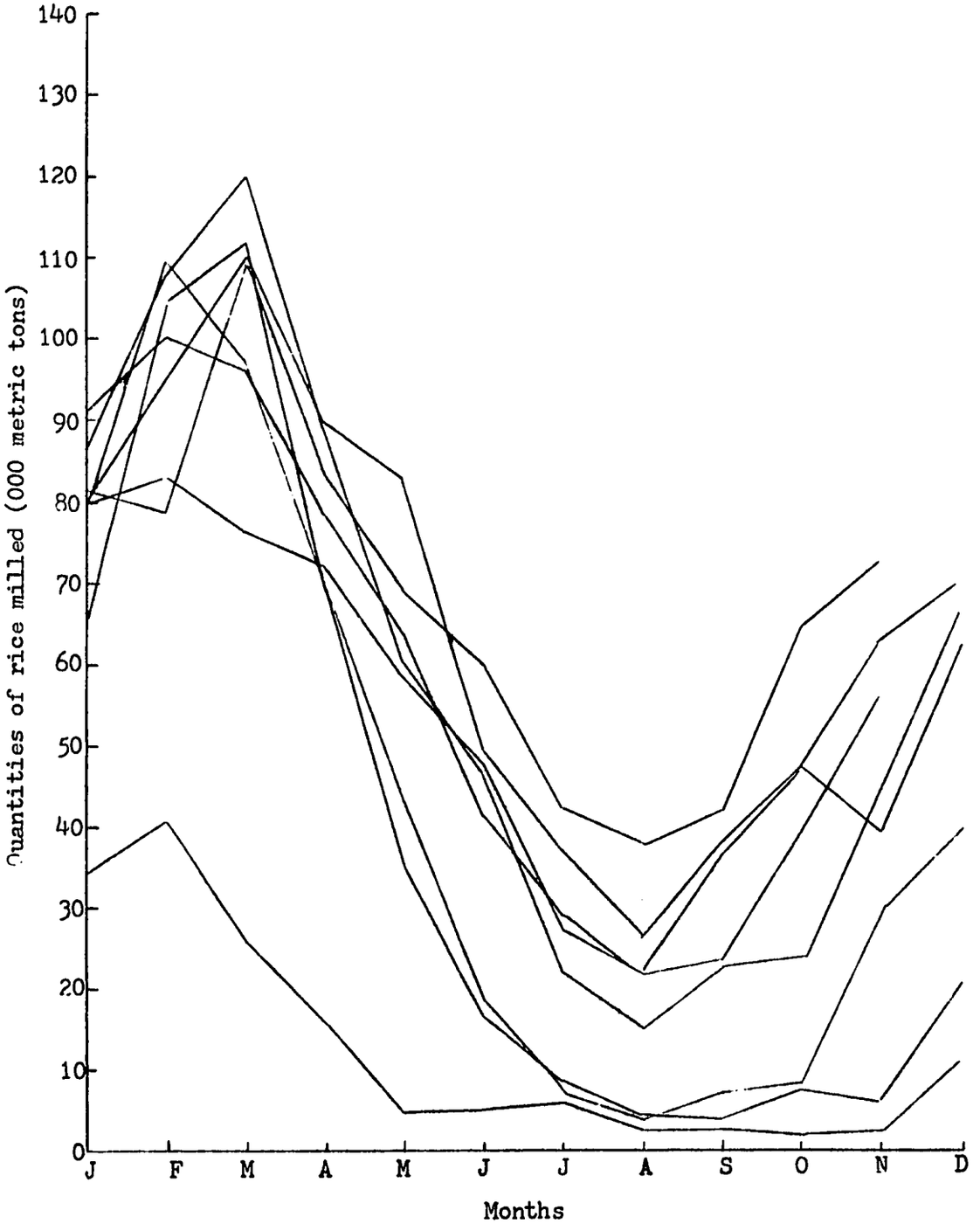


Figure 4. Monthly production of rice by organized rice mills, West Bengal, 1960-1967.



This divergence between private and social return is obviously a result of the manner in which market forces are structured either through lack of appropriate policies or through misguided ones which not only raise the variable costs of operation, but frequently make it almost impossible to predict returns on operations with any degree of certainty. It is also a function of environmental restraints built into the traditional technology of drying and parboiling. There is obviously a great scope for public policy with respect to prices, stocks and credit on the one hand and technology on the other to change this state of affairs.

Underutilization of capacity does not have a considerable impact on milling costs in the traditional rice mills as fixed costs constitute a small proportion of the total milling costs. To the extent that underutilization is due to environmental restraints, it would be eliminated in the process of modernization that would involve replacement of the traditional technology. However, underutilization that is due to market forces will have significant impact on costs in the context of modernization of the rice milling industry where fixed investment is much larger. The higher capital requirements have two implications. First, this would influence unit fixed costs and hence market margin more significantly than now and second, it would mean greater allocation of capital per unit of unused capacity than now due to higher capital requirements of modern mills. It raises some important questions about the size of the modern milling plants and their competitive position in the future.

Factors Affecting Milling Structure

We have already seen how utilization of milling capacity in the organized sector during the period of free trade seemed consistent with the optimization of returns in milling operations. It is now necessary to examine the phenomenon of rapid increase in the number of single hullers in the unorganized sector and the trend away from large rice mills.

In several areas, such as West Bengal, husking machines have clearly replaced handpounding which was prevalent in domestic consumption of rice in the rural sector. Official estimates indicate that prior to the Second World War as much as 84 percent of the total paddy production of the state was handpounded.[24] The extent of handpounding had declined to 70 percent in 1953-1954.[25] A few rice millers in West Bengal estimated the extent of handpounding at about 30 to 40 percent in 1967, with husking machines processing more than two-thirds of the balance.[26]

The increase in the number of husking machines is also partly attributable to the governmental policies that have directly and indirectly encouraged their establishment in a variety of ways. We have already explained how in areas such as West Bengal, single hullers

have clearly proved to be an alternative channel of marketing during periods of price controls and statutory levies.

Government policies indirectly encouraged development of an unorganized rice milling sector by policies which discouraged growth of the organized milling industry. The 1958 Rice Milling Act, although it did not directly control expansion of the organized milling sector, created a great deal of uncertainty in the private sector regarding its future and hence discouraged investment in large scale mills involving considerable capital. The 1958 Congress resolution propagating nationalization of grain trade further discouraged modernization in the private sector since the threat seemed more real in the case of a modern efficient sector than in the case of an outmoded and inefficient one. The substantial fluctuations in marketed surplus resulting from the official procurement policies also provide a further discouragement to the expansion or the modernization of the organized private milling sector.

A factor which has been no less inhibiting in the modernization process until recently is the lack of technical knowledge on the part of millers regarding establishment and operation of modern rice mills. Until the Ford Team examined the question of modernization,[27] the government neglected the issue completely while emphasizing the merits of handpounding if not in deeds at least in words. It neither provided millers with a knowledge of modernization--which is as necessary as extension of new varieties of crops to cultivators, nor financial assistance for initiating the modernization process. Rice mills along with oil and dal mills were classified as a "traditional industry" and, therefore, did not qualify for financial support for modernization.[28] A further problem in modernizing lay with the difficulties of marketing pure bran which resulted from the lack of development of a bran extraction industry.

Finally, expansion of the traditional single hullers was also an indicator of the lack of alternative opportunities of investment for persons in small towns with little capital and some know-how of the working of the paddy rice trade. Development of small and medium scale industries in the rural areas of the rice growing states was conspicuous by its absence during the two decades of stagnant agriculture. The dynamism of agriculture and the consequent spurt in small industries in rural Punjab in recent years are an example of the effect of profitability on channelization of small savings.

Policy Implications

The examination of the traditional rice milling industry suggests that the number of mills in the organized sector increased sufficiently to maintain a fairly high degree of competition. However, there probably was not so much underutilization of capacity as to provide rigorous competition among millers as one may believe from examining the over-all

increase in the number of milling units. The large addition of single hullers mostly took over the paddy that was handpounded before, and did not take over processing of the marketed surplus to a significant extent except in periods when government policies restricted and impeded the organized rice milling sector. The nature of this development in the rice milling industry thus did not positively foster competition. Hence, it did not exert a pressure on reducing milling margins.

Apart from competitiveness, the structure of the milling industry also had a significant effect on milling costs through technological factors.

A great deal of scope obviously exists for a positive, facilitative governmental policy to correct these features in the future. There seem to be at least four ways in which this could be brought about. First, a favorable atmosphere needs to be created which would encourage private investment in technologically superior milling equipment. Second, a need for extension of technical knowledge ought to be recognized and a positive program adopted for making millers in the private sector aware of the modern milling technology. Third, credit should be made available to millers for modernizing existing rice mills so as to foster competition between those who can raise their own capital and those who for lack of capital would fail to modernize. Four, a price policy which would stabilize the pattern of off-seasonal price movements and market supplies from year to year would considerably reduce uncertainty in the trading operations thereby increasing utilization of effective capacity and thus decreasing average costs and increasing competition.

Part II

Working of the Modern Rice Mills--Two Cases

Examination of the efficiency of the existing rice milling industry has been of interest from the point of view of the effect of governmental policies on structure, competition, capacity utilization and milling technology that evolved in the past. Working of the modern rice mills is of considerable interest from the viewpoint of costs of processing likely to exist in the future and their implications for size of firms that should be adopted. Since the modern rice mills have not been working in an open market, little can be said about the purchase and stocking practices that they may adopt in a free market under conditions of imperfect knowledge and uncertainty. As we illustrated earlier, both of these factors have a very significant effect on pattern and degree of capacity utilization. Here we examine the operational costs of modern rice mills almost completely in isolation from the market forces, to illustrate their implications for firm sizes that should result from modernization of rice mills.

Data on operation of the modern rice mills are much too inadequate to do a full justice to the analysis of their efficiency. Although the first seven modern mills started functioning by late 1965 or early 1966, erection of all facilities was not completed until the middle of 1969. The official procurement policies in various states made it difficult for the modern rice mills to procure paddy at government-fixed prices.[29] Further, the rice mills had the usual teething problems of inadequate trained personnel, supply of spare parts and timely repairs which also affected their capacity utilization. All of the seven mills, therefore, operated at well below their engineering capacity during the first few years.

A modern rice mill in West Bengal, which has a capacity of two tons per hour (TPH) or approximately 12,000 tons per year milled 4,792 tons in 1968, 5,836 tons in 1967, and only 3,000 tons in 1965. The mill thus operated at less than 50 percent of its capacity in the three preceeding years.

Another rice mill in Tamil Nadu has a capacity of 4 TPH or about 24,000 tons per year. The mill milled 4,521 tons of paddy in 1965, 5,775 tons in 1966, 14,343 tons in 1967 and 20,479 in 1968.

For this study data were collected from two modern rice mills in West Bengal and Tamil Nadu. Among all the modern rice mills in India, the mill in Tamil Nadu has provided exceptionally good leadership in the establishment and day to day operation of the rice mill.[30] The Tamil Nadu rice mill is thus by no means representative of the stereotype about cooperatively-run enterprises in India. The rice mill in West Bengal encountered several problems initially both in the establishment as well as in the management of the mills. It, however,

made significant progress subsequently and seemed to be well under way in increasing utilization of its capacity. The two mills thus show a significant difference in their management.

The mills, however, show an even more significant difference in their capitalization as shown below from the actual costs of their establishment.

The significantly high costs of construction of silos in Tamil Nadu were due to two main reasons. A certain degree of over-cautiousness in the construction of the first set of silos resulted in higher costs of construction. Second, considerable research in the construction of silos has provided possibilities of several alternate types of silo constructions which have further reduced costs. We have, therefore, provided an alternate estimate of the capital costs of silos in Tamil Nadu.

Table 5. Some alternate estimates of capital costs of two modern mills.

Actual capital costs	West Bengal	Tamil Nadu
	(000' Rs.)	
1. Land	195.00	)
2. Buildings	39.33	)410.00
3. Mill warehouse	1.81	)
4. Permanent warehouses	180.00	2,200.00
	(flat warehouses)	(silos)
		600.00
		(silo accessories)
5. Mill equipment and machinery	323.48	1,330.00
6. Total capital cost (1+2+3+4+5)	739.62	4,540.00
7. Proposed silo	900.00	--
8. Revised estimate of existing silos*		1,656.00
9. Revised total capital costs (6-4-5+8)	1,639.62	3,396.00

*Based on interviews of G.V.K. Moorthy and James E. Wimberly.

Source: West Bengal Apex Co-operative Agricultural Marketing Society and Thanjavur Co-operative Marketing Federation.

Variable and Fixed Costs of Milling

Table 6 shows the variable costs of milling in the West Bengal and the Tamil Nadu rice mills. Data for West Bengal are for the calendar year 1968, those for Tamil Nadu are on a monthly basis for 1969. Table 7 shows the alternate estimates of unit fixed costs at different levels of capacity utilization in the two rice mills.

Table 6. Actual per ton variable costs of processing paddy in modern mills.

	West Bengal[1]		Tamil Nadu[2]
Average for 1968	Rs. 12.68	July	9.45
		August	15.35
		September	23.09
		October	24.95
		November	13.79
		December	22.34
		Weighted average[3]	16.65

[1]Costs for West Bengal include factory maintenance, electricity, oil and fuel and all wages. No breakdown was available according to salaries and wages.

[2]Costs for Tamil Nadu include factory maintenance electricity, steam unit expenses and wages. They do not include salaries, which are considered to be fixed costs. The estimate for West Bengal thus somewhat overstates the variable costs due to inclusion of salary component in them.

[3]Weighted by the quantities of paddy milled.

It must be noted that these costs do not include either the purchasing costs of paddy or the interest costs on working capital. It is generally recognized that since milling involves storage of paddy, for a considerable period of time, interest costs on working capital are quite substantial. V. K. Gupta, in his analysis of rice mills contends that interest costs on working capital are so high that it is, therefore, perhaps more profitable to have large capacity mills and to operate them only during the season rather than having small mills with plants and facilities to store paddy for lean season operations.[31]

Our data suggest that fixed costs may vary significantly for different sized rice mills for the same quantities of paddy milled i.e., at different levels of capacity utilization (Table 7). The data for the two rice mills show considerably higher per unit fixed costs in the Tamil Nadu rice mill as compared to the West Bengal mill. This is obviously due to the higher degree of capitalization of the Tamil Nadu rice mill. We show below two different patterns of milling that could be followed to mill 12,000 tons of paddy. Under Plan 1, milling is undertaken in a 2 TPH rice mill all through the year.

Table 7. Alternate estimates of unit fixed costs at different levels of capacity utilization, West Bengal and Tamil Nadu.

Level of capacity utilization (tons)	Tamil Nadu			West Bengal	
	1	2	3	1	2
	(Rs. per ton)				
1,000	169.6	794.6	638.8	127.9	268.8
2,000	84.8	397.3	319.4	63.9	134.4
3,000	56.5	264.9	212.9	42.6	89.6
4,000	42.4	198.6	159.7	32.0	67.2
5,000	33.9	158.9	127.8	25.5	53.8
6,000	28.3	132.4	106.5	21.3	44.8
7,000	24.2	113.5	91.3	18.3	38.1
8,000	21.2	99.5	79.8	16.0	33.6
9,000	18.8	88.3	71.0	14.2	29.9
10,000	17.0	79.5	63.9	12.8	26.9
11,000	15.4	72.2	58.1	11.6	24.4
12,000	14.1	66.2	53.2	10.1	22.4
13,000	13.0	61.1	49.1		
14,000	12.1	56.7	45.6		
15,000	11.3	53.0	42.6		
16,000	10.6	49.7	39.9		
17,000	10.0	46.7	37.6		
18,000	9.4	44.1	35.5		
19,000	8.9	41.8	33.6		
20,000	8.5	39.7	31.9		
21,000	8,0	37.8	30.4		
22,000	7.7	36.1	29.0		
23,000	7.4	34.5	27.8		
24,000	7.1	33.1	26.6		

Footnotes to Table 7:

Tamil Nadu: Estimate 1 is based on the data supplied by the Tamil Nadu modern rice mill on depreciation of machinery and buildings, taxes, insurance and (TMRM) salaries. Estimate 2 includes TMRM's data on taxes, insurance and salaries. Depreciation of buildings and machinery are, however, obtained independently as 5 percent and 10 percent of the capital costs respectively. Interest on fixed capital is calculated at 9 percent per annum and added to fixed costs. It should be emphasized that estimate 1 does not include any interest charges.

The third estimate is very similar to the second, except that it uses the revised capital costs of silos for depreciation and interest.

West Bengal: Estimate 1 for West Bengal includes depreciation of machinery and buildings at 5 percent and 10 percent of their capital value respectively plus interest on fixed capital at 9 percent per

Table 7 Footnotes (continued)

annum, and insurance. It does not include salaries of the permanent staff. However, since the total wage bill for 1968 was only Rs. 11,000 exclusion of salaries does not significantly understate the unit fixed costs, particularly at high levels of capacity utilization.

Estimate 2 includes all the components in estimate 1 plus depreciation and interest on the proposed silos. The estimated costs of the proposed silos as provided by the marketing society were divided according to costs of buildings and accessories to arrive at separate estimates of depreciation of buildings and equipment. Interest rate is assumed to be 9 percent per annum

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Under Plan 2, milling is confined only to the first five months. The two plans show a significant difference in the interest costs incurred on working capital. From Table 7, however, it is clear that the per unit fixed costs of the two rice mills at 12,000 ton per year capacity are substantially different. The figures presented below show that the savings in interest charges brought about by utilizing the larger rice mill at only 50 percent capacity are not compensated by the higher per unit fixed costs in a larger rice mill.

Savings in interest in milling 12,000 tons of paddy in a 4 TPH rice mill = Rs. 153,853.8 - Rs. 27,340.00 = 126,513.8 (from Tables 8 and 9) Additional fixed costs of milling 12,000 tons of paddy (from Table 7) = (Rs. 53.2 - Rs. 22.4) = Rs. 30.8 x 12,000
= Rs. 369,600.00

It is noteworthy that these results are based, for Tamil Nadu, on the fixed costs which use the lower costs of silos rather than the actual which are much higher, and for West Bengal on fixed costs which include costs of the proposed silo construction. We, however, used market rate of interest rather than the actual interest costs incurred by the two rice mills to emphasize the real social cost of capital.

Data on variable costs of processing presented in Table 6 show a significant variation in direct processing costs from one month to another in case of the Tamil Nadu rice mill, and show almost invariably higher per unit direct processing costs (i.e., variable costs) than those derived for the West Bengal rice mill from the data for 1968. It is noteworthy that the variable costs in West Bengal are lower than those in Tamil Nadu despite the fact that wages and salaries are included as variable costs in West Bengal whereas only wages are included as variable costs in the case of Tamil Nadu. The higher unit variable costs in Tamil Nadu seem particularly curious as almost all of the rice produced in Tamil Nadu was raw, whereas at West Bengal only boiled rice was produced.[32]

To recapitulate, some interesting features of the nature of the costs are noted from the statistics presented above. First, the data show that within a single firm considerable variation in average fixed

Table 3. A milling pattern of a 2 TPH rice mill for milling 12,000 tons of paddy per annum--Plan I.

Month	Quantity of paddy purchased (tons)	Quantity of paddy milled (tons)	Carry over stocks (tons)	Value of carry over stocks[1] (Rs.)	Monthly interest costs of carry over stocks[2] (Rs.)
December	3,000	1,200	1,800	111,600	8,370.0
January	3,000	1,200	3,600	223,200	17,667.3
February	3,000	1,200	5,400	334,800	21,092.4
March	3,000	1,200	7,200	446,400	28,123.2
April		1,200	6,000	372,000	23,436.0
May		1,200	4,800	297,000	18,748.8
June		1,200	3.600	223,200	17,667.3
July		1,200	2,400	148,800	9,374.4
August		1,200	1,200	74,400	4,687.2
September		1,200	1,200	74,400	4,687.2
October		--	--	--	
November		--	--	--	
Total	12,000	12,000	372,000	2,305,800	153,853.8

[1]At Rs. 620 per ton of paddy.

[2]At 9 percent per annum.

Table 9. A milling pattern of a 4 TPH rice mill for milling 12,000 tons of paddy per annum--Plan II

Month	Quantity of paddy purchased (tons)	Quantity of paddy milled (tons)	Carry over stocks (tons)	Value of carry over stocks[1] (Rs.)	Monthly interest costs of carry over stocks[2] (Rs.)
December	3,000	2,400	600	372,000	2,343.00
January	3,000	2,400	1,200	744,000	4,687.00
February	4,000	2,400	2,800	1,736,000	10,936.00
March	2,000	2,400	2,400	1,488,000	9,374.00
April	--	2,400	--	--	--
May	--	--	--	--	--
June	--	--	--	--	---
July	--	--	--	--	--
August	--	--	--	--	--
September	--	--	--	--	--
October	--	--	--	--	--
November	--	--	--	--	--
Total	12,000	12,000	7,000	4,340,000	27,340.00

[1]At Rs. 620 per ton of paddy.

[2]At 9 percent interest per annum.

costs would occur according to variation in capacity utilization. Second, they show that considerable variation exists in average fixed costs between the two modern mills for milling the same quantities of paddy, even when lower capital costs of silos are used for the Tiruvarur rice mill.

The evidence further suggests that, if anything, per unit direct processing costs are likely to be higher in a larger rice mill than in a smaller one. Thus given the larger capital costs of modern rice mills as compared to those of the traditional mills on which Gupta's analysis is based, the saving in interest on working capital derived from a partial utilization of a large rice mill may not necessarily compensate for the larger unit fixed costs. This is likely to be even more significant due to the differing levels of capitalization possible in different sized rice mills.[33]

An additional aspect which is often overlooked in cost accounting of different sized mills is the natural inclination for vertical integration in a larger sized mill due to the availability of by-products as raw materials. An excellent example is the setting up of the oil extraction unit in Tamil Nadu rice mill with a capacity of 45 tons of rice bran extraction a day at the cost of Rs. 1.8 million. It was hoped that the mill will produce enough rice bran to keep the plant running more or less at full capacity. However, due to the problems of procurement and disposal encountered by the rice mill itself plus the problems of procuring bran from other mills the oil extraction plant has been operating at less than 50 percent capacity, thus further adding to the heavy overheads, which we have excluded from our cost estimates.

However, even if it is assumed that both small and large mills operate at full capacity the costs of operation of the larger mills are likely to be higher at least for two reasons. First, since a large rice mill has to build considerably larger stocks it may have much less flexibility in purchasing paddy as well as in disposing rice. It may purchase considerable quantities of paddy later in the season at higher costs. V. K. Gupta's evidence rather clearly shows a rather high positive correlation between quantities of paddy purchased and unit costs of paddy procured.[34] The procurement costs may also be higher as the mill may have to procure supplies from a much larger geographical area involving not only higher transportation costs but also problems of coordination and supervision of procurement. The losses both in milling and storage may also be higher due to improper handling resulting from heavier accumulation of paddy and rice stocks.[35]

Policy Implications

The conclusions that follow from the examination of the two modern rice mills seem consistent with the policies recommended earlier from the examination of the traditional rice mills. These policies have significant implications for plant size, location of plants

and obviously for the ownership pattern likely to follow. For several reasons, it seems highly likely that rice mills in the private sector would tend to be small units of one, two, and only occasionally of four ton per hour capacity. Private millers are more likely to be mindful of the costs of under-utilization than the cooperative or governmental mills due to their experience about working in the uncertain paddy markets. This will be even more reinforced by the fact that millers will have to borrow capital at the going market rate unlike their cooperative and governmental counterparts who may receive subsidized credit for establishment of modern mills.

Loans from the commercial banks, unlike government loans to governmental agencies, will also have to be repaid according to the lending terms. It thus seems that investment decisions will be based more on economic calculus of cost-returns in the private sector than in the public and cooperative sector.

It also seems probable that mills in the private sector would have a much less tendency for over-capitalization. The higher cost of credit may encourage them to streamline investment. It may be particularly important in an uncertain market to keep fixed costs to the minimum so as to avoid high costs of under-utilization of invested capital. Private rice mills are also likely to be smaller due to the limited working capital available with the traders and their desire to be independent in stocking operations which discourages them from depending heavily on bank credit for working capital.

Emphasis on modernization of existing private mills rather than establishment of new ones obviously implies preference for the existing geographical location of mills over any other likely to follow. Most private mills in the organized sector are usually located in primary, secondary and terminal market centers, that are well connected with each other by railways and roads. Because of the large number of millers, traders and commission agents operating in these wholesale markets prices are more likely to be competitive than would be the case otherwise.[36] Also because of the traditionally organized flows of marketing, problems of channeling paddy supplies for procurement will be minimized.

Of course, the intent of these policy recommendations is by no means to deny the role that public sector rice mills will have to play in the future in India. With large buffer stocks planned in the public sector, it will handle a large quantity of the marketable surplus of paddy which may conveniently be milled through public sector rice mills.

It is, however, questionable whether the public sector or the cooperative sector should expand beyond this point, except on a purely cost-return calculus and on a competitive basis with the private sector.

Part III

Expansion of Storage Facilities

Considerable debate has occurred in India in the recent years regarding the storage question. The debate mainly concerns the costs of different types of new storage constructions and the relative advantages and disadvantages of different storage facilities. We will examine these questions in detail below.

Costs of Storage Construction

The debate on types and sizes of storage facilities and on the costs and benefits of flat versus silo storages was prompted by the high costs of construction of silos in the initial stages of rice milling modernization. The silos constructed by the Thanjavur Co-operative Marketing Federation at Tiruvarur, cost Rs. 2,800,000 for a capacity of 7,200 tons or approximately Rs. 400 per ton. These costs seemed exceptionally high when compared with the estimated cost of Rs. 125 per ton in case of flat storages proposed by the National Co-operative Development Corporation. It was believed in several quarters that any gain through increased efficiency of storage in silos would be more than compensated by the excessively high costs of their construction and hence a call for expansion of flat storages. Several interesting features of the costs and benefits of the two types of storages are revealed by the existing evidence on the storage question. First, costs of flat storage of equivalent capacity are not as low as generally indicated by the initial estimates of construction costs. For example, data collected by the Ford Foundation on actual building costs of godowns in the public and cooperative sector in some IADP districts show that the actual construction costs of flat godowns varied from Rs. 80 per ton in Sambalpur (Orissa) to Rs. 180 per ton in the case of some godowns in Thanjavur district, Rs. 200 per ton in Raipur district, M. P., and Rs. 220 in Mandya district in Mysore and Thanjavur district in Tamil Nadu.[37] The Food Corporation's estimate of Rs. 20 per square foot of godown area in their modern rice mills amounts to approximately Rs. 240 per ton.[38] The variation in construction costs are not always explained by the variation in quality of godowns, and in any case even the best godowns have cost much more than the initial estimates in many cases.

Second, the high costs of construction of silos initially was a result of at least two factors. First, a sellers' market existed in silo construction in the early stage which resulted in monopoly profits for the few who were in the construction of silos. A great deal of competition now exists between contractors for obtaining bids which has helped bring the costs down. Besides, more research in the construction of silos has brought forth possibilities of using a

variety of designs (affecting gradients and location of hopper bins) and materials (such as steel and concrete versus all contrete). This has brought construction costs down substantitlly. Our interviews of construction contractors and engineers indicate that silos may now be constructed at as low a cost as Rs. 230 to Rs. 250 per ton. This includes Rs. 150 to Rs. 170 per ton as construction costs plus Rs. 80 per ton, cost of equipment. These estimates seem consistent with the tenders offered by private construction companies for construction of a 4,000 ton silo in Memari. One estimate for a steel silo amounted to Rs. 900,000 or Rs. 225 per ton.[39] Both of these facts suggest that the differences in the capital costs of flat and silo storage are not as great as initially believed.

Recurring expenses of storage are more difficult to determine as handling charges and storage losses would vary according to the rate of turnover. However, our interviews of officials at modern rice mills indicate that recurring expenses in flat storages may be higher due to (1) greater handling costs, (2) higher maintenance costs of flat warehouses, (3) a high cost of storage whenever storage is done in bags and (4) somewhat higher physical losses of grain. This is supported by Wimberly's estimates of operational costs in flat and silo storage in the case of the modern rice mill in Tiruvarur, given below. On balance, silo storage thus appears more efficient strictly from a narrow comparison of the economics of the two systems.

Some Additional Questions Regarding Storage

There are, however, various other considerations which must enter into investment decisions regarding different types of storages. A major objection generally raised to silos is that given the level of technology generally prevailing in the Indian marketing system, silos may not always be the most practical form of storage. Implicit in this objection is the lack of bulk handling, transportation and processing that would make silos a less effective form of storage in Indian conditions.

However, there are certain other factors which also must be considered. The Indian grain trade is characterized by a large number of varieties which often must be kept separate to cater to consumer preferences. Flat storage is much more suitable for this purpose than silos. Flat storage is also a multi-purpose storage where a combination of different items could be stored simultaneously thus making for more effective use of capacity utilization as compared to silos that must be used for storing a single type of grain at a time.

Also important is the fact that there is probably a great deal of flexibility possible in the size of flat storages whereas silos may have to be of a certain size in order to reach minimum capital costs. Our investigations of this question through interviews with

Table 10. Operational costs in silo and flat storage for 7,200 metric tons for three months.[1]

		Rs.
I.	Operational Cost in Silo Storage	
1.	Cost of staff and factory wages	5,850
2.	Electricity	2,416
3.	Maintenance	1,500
4.	Depreciation for silos @ 2½% on Rs. 2,400,000	15,000
5.	Depreciation on machinery @ 10% on Rs. 320,000	8,000
6.	Interest on Rs. 2,700,000 @ 7½%	50,625
Total		83,391
		(Rs. 3.86/ton/month)
II.	Operational Cost in Flat Storage	
1.	Godown staff 3400 x 3	10,200
2.	Lighting charges and contingencies	900
3.	Interest on capital cost @ 7½% on Rs. 1,200,000 for flat storage	22,500
4.	Depreciation @ 5% on Rs. 1,200,000 for flat storage	15,000
5.	Unloading and stacking charges @ Rs. 1 per ton	7,200
6.	Loading and other handling charges @ Rs. 1 per tenne	7,200
7.	Interest on investment of Rs. 207,360 for gunnies @ 9% for 3 months	4,882
8.	Depreciation on gunnies at 40 paise per gunny for 129,600 gunnies	71,840
Total		139,722
		(Rs. 6.46/ton/month)

[1]These estimates do not include storage losses which are estimated to be somewhat higher in flat storages as compared to silos.

Source: James E. Wimberly, Rice Processing Consultant, The Ford Foundation, New Delhi, Unpublished data.

engineers suggest that in the case of silos, there is a rather clear indication of declining unit costs of construction up to a certain point after which they rise rapidly. No such relationship between the size of flat storage and the unit costs of construction has been established.

The economics of storage types must evaluate all of these factors in determining an economically efficient investment. Neither

of the two types of storages is probably universally superior to the other under Indian conditions; the superiority is determined by the function and the length of storage and by the agency which may undertake such a storage method. It is likely that silos would have a great deal to recommend themselves in the public sector where a minimum size of storage for specific grains may make sense from capacity utilization point of view, where length of storage may call for minimizing losses in long term storages and where handling facilities may prove more effective for bulk vertical storage. Flat storage may, however, make considerable sense in the private trading sector where the scale of the operation is likely to be small, turnover high and multi-purpose storage facilities necessary. There is also an additional factor which may be of significance in the case of flat storage. The divisible nature of its construction and hence small capital requirements, may bring forth considerable capital from the private sector which is otherwise unlikely to flow into construction of silos.

It is now generally recognized at the higher levels of decision making that a much more flexible policy will be required in the case of new storage construction. What is, however, not recognized is that by not providing a positive incentive to the private sector for construction of new storage space and for improvement of the vast amount of existing storage facilities and by maintaining a great deal of uncertainty regarding the trade's future existence, the government has throttled a very major source of storage capacity expansion. This is inevitably going to affect the quality and quantity of storage capacity available to handle the forthcoming increases in marketings. A much more facilitative role could be played through public policies by regulating and enforcing minimum scientific standards in private warehouses, through making use of insecticides popular and mandatory and by making banking finances available to the private sector for rennovation and new construction of warehouses. In the final analysis whether the private sector is allowed to play a role in construction of storages will have to depend on the decision about the over-all control of the marketing system. However, this is an area where the private sector could play a vital role in the modernization of the marketing system.

APPENDIX

Official Policy Toward Rice Milling Industry

The first official action after independence on rice milling consisted of appointment in October 1954 of the Rice Milling Committee to investigate the working of the milling industry and to recommend policies for its development. The committee was concerned neither with the economics nor with the technology of milling. Its prime concern seemed to be employment. It recommended encouragement of handpounding on the grounds of its high labor intensity. It further recommended a ban on setting up new mills except in special circumstances. The recommendations were consistent with the policy of encouraging handpounding in the First Five Year Plan under the common production program.

In keeping with the Milling Committee's recommendations, the Rice Milling Industry (Regulation) Act was issued in May 1958 which prohibited the establishment of new rice mills, or the expansion of the existing ones or the reopening of defunct mills, except under permits from the government. These permits would be issued only after verifying whether the grant of a permit was necessary for ensuring an adequate supply of rice and whether the functioning of the rice mill for which a permit was required would cause substantial unemployment in the locality and adversely affect the handpounding industry. The rules framed under the Act provided that in granting a permit for the establishment of a new rice mill, preference would be given to a sheller mill. All of the powers under the Act were delegated to the state governments. The nature of the Act thus left a great deal of leeway to the states in interpreting the need for establishment of new mills. The state governments almost never positively encouraged handpounding as proposed under the common production program and almost always neglected the employment aspect in giving licenses to new mills. The governments continued to give licenses to rice mills in the organized sector, although fewer licenses were issued to large rice mills and many more to single hullers.

The officially recorded number of rice mills increased from around 20,000 in early fifties to approximately 50,000 at the end of the sixties. Most of the increase was of single hullers. Until 1963, the policy oscillated between handpounding and mechanical milling with little improvement in the milling technology. In 1963, however, a team of Ford Foundation experts looked into the working of the rice milling industry and recommended an integrated approach toward processing consisting of more scientific drying, storage, parboiling and milling of paddy. Modernization called for much more capital intensive processing techniques. The team effectively illustrated the considerable gain in the quality and quantity of rice and by-products that would ensue from a complete modernization of the industry. In July 1964, the Food Department set out to establish

India's first seven imported modern rice mills, six of which were established in the cooperative sector through the initiative of the National Co-operative Development Corporation and one in the public sector. The Food Corporation subsequently established 25 more modern mills. Several additional modern mills are under way in the cooperative sector. The Food Department also established 30 paddy-drying centers equipped with mechanical dryers with the financial assistance of the Ford Foundation.

In the initial stages, the role of the private sector in the modernization program seemed highly obscure. The policy subsequently outlined, however, called for the provision of credit to the private sector for modernization of the existing rice mills. If all goes as planned, India will have enough modern rice mills to mill the additional 20 million tons of paddy expected to be produced by the end of the Fourth Five Year Plan.

FOOTNOTES

[1] Report to the Government of India on Increasing Milling Outturns of Rice from Paddy in India, H. D. Faulkner, George W. Reed and D. D. Brown, September 1963 as quoted by James E. Wimberly, Evaluation of Modern Rice Milling Program in India, The Ford Foundation, New Delhi, October 1969, p. 1.

[2] Ibid.

[3] Rice Milling Industry in India--Proposals for the Fourth Five Year Plan, Department of Food, Ministry of Food and Agriculture, Government of India.

[3a] See Uma J. Lele, Food Grain Marketing Systems in India: Private Performance and Public Policy, Cornell University Press, Ithaca, N.Y. Forthcoming, Also see John W. Mellor, Uma J. Lele, Thomas F. Weaver, and Sheldon R. Simon, Developing Rural India, Cornell University Press, Ithaca, N.Y., 1968, pp. 237-291.

[4] Central Food Technological Research Institute, Mysore, (CFTRI), Report on Evaluation of Modern Rice Mills in Comparison with the Existing Mills, p. 7.

[5] In Tamil Nadu, approximately 4 to 5 unskilled and semiskilled workers are employed per ton of paddy milled in traditional huller mills as against one skilled worker per one to $1\frac{1}{2}$ tons of paddy milled in a modern mill.

[6] For making such estimates we used a standard accounting procedure of assuming a rate of 10 percent depreciation on machinery and equipment and 5 percent on buildings. We also used market rate of interest of 9 percent per year rather than a rate of 5 percent on part of the capital and zero percent on the rest as done in several official evaluations earlier. Our estimates for Tamil Nadu rice mill show that unit fixed costs vary from Rs. 980 per ton when only 1,000 tons of capacity is used in a 24,000 ton-annual capacity rice mill, as against Rs. 34 per ton when capacity is fully utilized. Although fixed costs are somewhat exaggerated, due to the accounting method of depreciation used, they rather effectively show the variability resulting from variation in utilization.

[7] CFTRI, op. cit., p. 7.

[8] Ibid., p. 7

[9] Ibid.

[10] Quality differences refer to various physical characteristics attributed to the appearance of the rice as different from varietal differences which are partly inherent and affect cooking quality and flavor for which consumer preferences are highly articulate in India.

[11]Roger A. Aspires, The Relationship Between Quality and Price in Philippine Wholesale Rice, International Rice Research Institute, Philippines, Unpublished Mimeograph.

[12]This is abundantly proved in various evaluation reports conducted of modern mills in India, by official and non-official agencies, that do not allow for increase in return due to improved quality of rice processed in modern mills. See for example V. K. Gupta, T. P. Gopalaswamy and D. P. Mathur, Studies on Modernization in Rice Paddy System, Indian Institute of Management, Ahmadabad, 1969, Report of the Committee on Rice Milling and Allied Problems Set up by the Food and Nutrition Board, Government of India, Rice Milling Industry in India - Proposals for the Fourth Five Year Plan, Department of Food, Ministry of Food and Agriculture, Government of India, and several other unpublished documents.

[13]The official explanation is that millers in West Bengal are required to surrender by-products whereas they are not required to do so in the other states. Our inquiries indicate that in fact, no by-products were ever recovered from millers. Nor is the difference justified by the temporary storage undertaken by millers subsequent to milling in West Bengal as explained by officials. There is not a significant difference in the duration of storage in West Bengal compared to other states.

[14]Millers, however, indicated that since the early sixties milling costs have nearly doubled due to higher costs of spare parts and repairs and due to higher taxes and licensing fees. Data collected by the Tamil Nadu State Department of Agriculture in its surveys in 1963 show the cost of milling to be Rs. 3.15 in Alandur market per quintal of rice, when rice was boiled once. In the case of double boiling, costs were slightly higher and amounted to Rs. 3.90 per quintal of rice at Erode, Rs. 3.60 at Tirrupur, and Rs. 3.45 at Karaikudi. At Mannachanallur, one of the largest milling centers in the South, the cost was 3.15 per quintal of rice in 1963. These data are in close agreement with what our estimates for 1969 would indicate if we extrapolated costs for earlier years on the basis of our interviews.

[15]Depreciation is calculated as 10 percent of the value of machinery and 5 percent of the value of buildings. Any overstatement of depreciation is probably somewhat counterbalanced by the fact that the effective capacity was generally not used fully and hence the unit fixed costs were slightly higher than those assumed here. There is an additional reason why costs may have been somewhat overstated. The data was collected in 1969 and refers to the 1968 calendar year. Interest on fixed capital was assumed to be 9 percent, the market rate in India in 1968-69. Interest rates were much lower in the fifties.

[16]The additions of the lowest fixed and variable costs does not coincide with the estimate of the lowest per unit total milling cost because the firm with the lowest variable costs did not necessarily have the lowest fixed costs. The estimates of the average total milling costs are arrived at independently by adding average variable and fixed costs for each mill.

[17]For a detailed discussion of the paddy and rice prices and the manner of estimating price spreads see Uma J. Lele, Food Grain Marketing Systems in India: Private Performance and Public Policy, Cornell University Press, Ithaca, N.Y., U.S.A., forthcoming. Examination of regional price disparities shows price differences between areas commensurate with transport costs.

[17a]It is noteworthy that regional price differences were generally commensurate with shipping costs during the same period, and although, seasonal price movements showed a considerable year to year variation, on an average, profits over a period of years seemed to have been adequate to cover storage costs and a reasonable return to the trader, see Uma J. Lele, op. cit.

[18]See Appendix for implications of the 1958 Act for the number of rice mills.

[19]Annual Survey of Industries, Central Statistical Organization, Department of Statistics, Cabinet Secretariat.

[20]Data for years beginning 1965 correspond with the official procurement of rice by the state government from millers.

[21]Our investigations show that several mills recorded as combined huller-sheller are, in fact, only huller mills.

[22]This may be a result of a variety of factors. The resources of small family operated mills may be much too small to permit hiring of managerial staff. It may also be a result of a lack of managerial talents or it may be a result of a strong desire to keep a firm within the family.

[23]For evidence on seasonal price patterns, pace of market arrivals and purchases by millers see Uma J. Lele, op. cit. V. K. Gupta provides some direct statistical evidence on the size of operation and costs of raw material in Raipur which clearly indicates that "raw material costs increased as the utilization of capacity increased and this formed the major chunk of the total cost." V. K. Gupta, T. P. Gopalaswamy and D. P. Mathur, op. cit., p. 165.

[24]Report on the Marketing of Rice in India, Ministry of Food and Agriculture, Government of India, 1955, p. 38.

[25]Report of the Rice Milling Committee, Ministry of Food and Agriculture, Government of India, p. 11.

[26]My conversation with millers.

[27]Modernization is defined here as the establishment of rubber roll sheller mills and a mechanical parboiling and drying system where parboiling is prevalent.

[28]It was only in October 1969 that the Reserve Bank formulated a policy of extending financial assistance to private millers for modernization.

[29]The unpublished reports of the Vaikunthlal Mehta Co-operative Management Training Institute, Poona on working of the modern rice mill in Mandya, Andhra Pradesh effectively show the procurement problems of the mill.

[30]See V. K. Gupta et. al., op. cit., for a detailed analysis of the management of the Tamil Nadu rice mill. Also see, James E. Wimberly, Evaluation of Modern Rice Milling Program in India, The Ford Foundation, New Delhi, October 1969.

[31]V. K. Gupta, et. al., op. cit., p. x.

[32]Out of the 17,814 tons of paddy milled in the Tamil Nadu rice mill in 1969 16,309 tons of paddy was milled in raw form.

[33]This is contrary to Wimberly's analysis which contends that unit fixed costs would show a sharp decline with increase in the size of the milling plant. This is obviously because Wimberly does not allow for differing degree of capitalization that may exist in small and large mills. Wimberly also uses unit fixed costs at full utilization of capacity of the different sized mills. See: James E. Wimberly, Cost Analysis of Rice Processing, A report submitted to the Ministry of Agriculture and Works, Government of Pakistan, March 18, 1969.

[34]V. K. Gupta, et. al., op. cit., p.

[35]Some recent evidence on the procurement problems and losses of so well managed a rice mill as the Tamil Nadu mill confirm these contentions.

[36]Uma J. Lele, Food Grain Marketing Systems in India, op. cit., for a great deal of evidence on this.

[37]Data obtained from the Ford Foundation, New Delhi.

[38]See Project Report: Setting up of Modern Rice Mills Under the Fifth Yen Credit. The Food Corporation of India, Government of India.

[39]Data obtained from the project engineer, West Bengal Apex Co-operative Agricultural Marketing Society.