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FEATURES

POST–HARVEST LOSSES AND SMALL FARMER STORAGE PROBLEMS IN SRI LANKA

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Post-harvest and storage losses are on the increase in Sri Lanka, particularly in the public sector organisations handling paddy and rice, flour and sugar, and fruits and vegetables, where physical losses have been found to be high. The deleterious effects of market intervention by state agencies in the field of paddy has tended to increase post-harvest losses, reduce employment, allow adoption of inappropriate technology and a moving away from renewable sources of energy (e.g. sun drying); and it has also induced the blocking up of scarce capital maintains Dr. Upali Nanayakkara, Director Marketing, Agricultural Development Authority, Sri Lanka, in this paper. As a solution he proposes a significant shift both in public policy away from price support programmes and handling various operations of paddy production by the public sector. He suggests a shift of these resources now utilised in these various paddy production functions to support programmes for an extended scale of research on the problems of small farmers, traders and private millers; while the private sector should be utilised more for basic trading functions of buying and selling, milling, storage and distribution in the food system.

A 1980 Workshop on (Post-Harvest Losses)P.H.LL examined the problem in terms of (a) perishable food items (b) durable food items and (c) fish losses. This paper will expand on the ideas presented at this Workshop in connection with items (a) and (b).

Perishable Food Items

These were categorised to include various kinds of (hill country and low country) vegetables, leafy crops and tubers, and fruits, all of which are derived essentially from plant sources. In practically all these areas of P.H.L L the causal factors have been identified more as being (1) technologically related factors (bruising during handling and transport; inability to increase shelf-life due to the absence of storage, processing and preservation facilities; poor techniques in packing, stocking, handling, movement, etc.) and (2) economic factors such as unprofitability to growers, lack of a stable market (whatever this may mean), periodic gluts and shortages, price fluctuations, etc.

Causality between the viarables indentified have not been established, however, through any objective measurement of the P.H.LL. referred to. More important, there appears to be little evidence to justify the adoption of any conceivable type of technology available (whether "appropriate", or otherwise) either in financial terms, or in terms of the micro-economic analyst's measure of the "opportunity costs" of resources. The Workshop Report indicates the existence of several disadvantageous natural factors which enhance P.H.L L. of perishables. The solutions to the problem have been indicated as improved data generation for better identification of the extent of the problem and the improvement of several intermediary functions more of a technical and technological nature, the setting up of grades and standards, and the provision of grower incentives.

Size of Losses

The size of losses have been indicated in this Report as ranging from a small percentage for fruits such as woodapple and pineapple; 25 percent for bananas by weight; 30 percent for tomatoes; 5 to 35 percent for hill country vegetables; and, perhaps. more for low country vegetables. All these appear to be rough "rule of thumb" estimates rather than precise measurements.

It is known, however, that the efforts of the Department of Marketing (a government institution responsible for the development of marketing involve physical losses of about 40% of its purchase of fruits and vegetables. This measure has been quoted by the Department from as far back as the early 1970s. It is our belief that this percentage is now higher on account of the increasing congestion in the major cities as a result of heavy rural-urban migration; conscious efforts at economic growth, which have generally favoured the urban sector, have speeded up the rates of flow of labour to the urban sector causing severe demand on the available infrastructure and have tended to block up produce flows to and from the metropolitan centres.

In this paper we wish to postulate the hypothesis that the existing system of perishable produce marketing by the private sector in Sri Lanka is economically efficient in the sense that the costs of any marginal changes in structural variables and/or the behaviour of its market participants, is not liekly to yeild commensurate benefits. The alternative hypothesis is that many non-marginal changes need to be made at this juncture in Sri Lanka's economic history to enable a significant reduction in the real resource costs of performing the marketing functions for highly perishable agricultural produce and that is only by such policy measures that this society may minimize P.H.LL. in this area. Changes in the location of break-bulk functions, a conscious shift to the use of "appropriate" rather than highly capital intensive technologies in performing these functions, the improvement of our techno-economic knowledge of seasonal production patterns and forecasting capacities, and significant improvements in our food science and food technology related capacities constitute some of these relevant non-marginal changes. Another non-marginal change may be to shift away from the public sector's performance of selling and distribution functions with regard (especially) to perishables. There is much in the way of research and development that could usefully constitute the role of the public sector.

P.H.LL. in perishables aggravate the problem of low real income levels of the Sri Lankan people. This society incurs high costs in performing the marketing functions for perishables. While relatively rapid changes are occuring in her capacity to raise the biological production function in small farm sector agriculture, the marketing problems are getting compounded by the rapid expansion of production capacity *'pari passu'* with increasing constriction of the channels and increasing marginal costs of pro-

cessing the growing volume flows. As a consequence, P.H.LL. are on the increase both in absolute terms as well as in proportion to production.. While there may be no objective estimates of losses in quantity or value terms, experience and judgement indicate that P.H.LL. are increasing at an increasing rate. Much can be done, we believe, by appropriate policy measures for the conscious reduction of P.H.LL. in perishables by changing the direction of our approaches to perishable produce marketing and the implementation of some of the development measures referred to above.

Specific storage problems

A few specific storage problems in regard to this perishable produce area may be highlighted. The cultivation of red onions is spreading to most parts of the Island today. However, the ability to spread out the cultivation into diverse production areas with different cultivation schedules or time periods, has still not been created. Experiments are needed to identify the potential additional costs of particular regions, starting later on in the cultivation season relative to the increased benefits from higher market prices for produce coming out during the off-seasons. The bulk of the production gets concentrated during the periods July to September and mid-January to mid-March in most parts of the Island. However, the knowhow of stacking or storing shallots is not yet extended to the new farmers entering into red onion cultivation. The storage and stacking knowhow of the traditional red onion farmers are, in this respect, adequate and perhaps "appropriate", but that of the new-comers into the industry are not.

In the case of potatoes, the major problem arises from the shortage of seed which is normally imported. Low cost storage bins are now being experimented with by the Department of Agriculture. The major goal is to develop simple outdoor wooden structures which admit diffused sunlight and thereby retard sprouting. Such simple storage structures constitute "appropriate technology"; and they could be used by small cultivators within their farmsteads. However, until this technology is developed, farmers have no means of storing potatoes for seed or to delay sales beyond the post-harvest slump in prices. Our experience is that a high proportion of the output handled by the Department of Marketing from the hill country potato crop was lost on account of the concentration of the harvesting season and the official pressure the Department of Marketing had to purchase this output at a guaranteed price. Since this is a non-traditional crop, simple storage technology has to be developed if P.H.LL. are to be reduced. Also, the strategy of floor prices and public sector purchases of such perishables need re-thinking at least in terms of P.H.LL. criteria.

Durable Food Items

The most important crop for Sri Lanka in the durable food area is paddy/rice, the yields of which have been growing systematically over the last few decades. In 1973 the domestic output of rice was 874,000 m.t. This increased to 1.07 mln in 1974;1.11 mln in 1977; and 1.42 mln in 1980 (representing approximately 89% of annual requirements). It may be justified to state that the potential exists for a rising trend in output expansion as the Department of Agriculture helps push further the intensive margin of cultivation through increased investments in research and extention and input supply co-ordination with the adoption of better management practices. Also, the extensive margin of cultivation is being pushed further in Sri Lanka at the present through a major irrigation scheme – the Mahaweli Project. In the circumstances, P.H.LL. of paddy/rice will be of much importance to this economy. Since the paddy sub-sector subscribed 29 percent of agriculture's contribution to the GNP during 1980, it is clear that a reduction in P.H.LL. within this sub-sector is likely to yeild high returns to investment.

The 1980 Workshop on P.H.LL summarized the type of losses in the paddy sub-sector as:–

"* Untimely harvesting, shattering, bird and rodent damage, and the effects of excessive sun and rain;

* Bundling, with additional shattering and exposure to the elements;

* Transportation and handling, with further shattering and contamination

* Threshing, where deterioration occurs in both quality and quantity;

* Drying and storage, where improper field stacking results, in quality and quantity losses;

* Milling, including inefficient parboiling practices; and

* High moisture deterioration and similar problems."

and in the rice-sector as

"* Paddy and rice losses in the Paddy Marketing Board's storage facilities;

* Food losses at the Food Department; and

* Food losses at the Cooperative Wholesale Establishment (CWE) when importing, storing, and distributing."

Here too, quantitative assessments of such losses are fragmentary. Paddy losses of the Paddy Marketing Board (PMB) during storage have been recorded by this agency as follows:

TABLE 1 – PADDY LOSSES DURING STORAGE IN P.M.B. STORES
1972 - 1980

Year	Losses (m.t.)	% of total handles
1972	395	1.50
1973	63	0.27
1974	87	0.42
1975	131	1.13
1976	102	0.79
1977	218	0.89
1978	571	1.77
1979	390	1.50
1980	107	1.06

Source: Paddy Marketing Board.

Thefts from PMB stores have not been recokened as storage losses for purposes of these data. The milling losses at PMB mills have been reckoned at 0.5 percent to 1.0 percent of the total weight handled by the organization. If additional processing is done to satisfy consumer needs, a further loss of 0.3 percent to 4.3 per cent of weight is reckoned.

The Food Commissioner (F.C.), the government department responsible for rice, flour and sugar imports, incurs certain physical losses in performing the logistics of import and distribution. The average physical losses have been estimated by the F.C. as amounting to approximately 1.0 percent to 1.5 percent of annual import volume. Imports during the ten year period ,1970 to 1980,were as follows:

TABLE 11
IMPORTS OF RICE, FLOUR AND SUGAR BY THE FOOD COMMISSIONER DURING 1970 TO 1981

		Volume ('000 m.t)	
Year	Rice	Flour	Sugar
1970	534	375	244
1971	339	336	288
1972	266	329	217
1973	343	371	194
1974	302	449	43
1975	460	463	62
1976	425	386	47
1977	543	532	100
1978	170	612	164
1979	211	474	249
1980	190	361	199
1981	157	–	–

Source: Food Commissioner

One is inclined to believe that the real value of resource losses by the public sector institutions handling locally produced paddy/rice activities and imports of rice, flour, sugar and other food items, must be higher than what the data would suggest. This is likely to be so because the variable of "quality" does not usually get reckoned when we take stock of the performance of "exchange" and "physical distribution" functions by public sector agencies which are generally inflexible in decision making. The absence of the powerful motive force of private profit through the efficient performance (as judged by speed of flow and the quality of such flows) of exchange functions, and low resource cost/use in physical distribution activities, usually aggravates the problems of inflexibility. Inventory costs are often high; stores may be stocked with produce which may be forgotten after a while specially if managers get to be transferred out regularly and the systems of management information communication and data retrieval are weak, a fact of acute less developedness. Insect and weevil infestation is often rampant as the reports of field and circuit officers would indicate. Even expenditure on fumigation or pest prevention may lag behind for long periods after pest attack on account of financial constraints, tortuous procedures and divided sectional responsibilities. One is likely to accept the hypothesis, therefore, that relative to the private sector, public sector performance of trading activities must be fraught with high P.H.LL. especially in the processes of storage and warehousing.

Incentive system

Another factor that may aggravate the problem of P.H.LL. by public sector agencies handling processing and distribution functions is the incentive system under which officers and workers in these organizations operate. Rather than being guided by least-cost considerations public sector for example, the market price of an item of sale is expected to rise in the near future, the public sector selling agency may be induced to hold back disposal even though an appropriate management costing (if carried out) may indicate that the total costs of holding are greater than the additional gains from the anticipated rise in unit price. In any case, the basic problem is often the absence of appropriate costing systems; modern cost accounting techniques are seldom adopted by public agencies at least for the fact that such labour commands high transfer prices. Also, our experience is that "capital" is generally assumed to be a "free good" by these agencies rather than a very scarce, economic, resource particularly for a very 'less-developed' economic system which Sri Lanka is. In any case, the point at issue is that the larger the stock that is held, the higher the probability of product losses not only through driage and pest damage, but also through pilferage. One is therefore, inclined to believe that the P.H.LL resulting from the public, sector's handling of food purchasing and distribution activities are higher than what the data would seem to reveal. The recurrent reports on wanton damage caused to public infrastructural facilities as well as produce merely to cover up corrupt practices provides reinforcement to the acceptance of this hypothesis of heavy produce losses in the public sector.

Identifying causal factors in post-harvest losses

Post production losses of paddy/rice in Sri Lanka have been estimated by Wimberley in 1974 as 25 to 30 percent. (1) (1980); These losses are said to arise from the perhaps avoidable pre-harvest probelm of shattering to the post-harvest problem of bundling, field transportation, threshing, drying and stacking, storage, etc., both on-farm and off-farm. Illangantileke had emphasized in 1979 that "Improper harvesting handling, threshing, processing, storage, and marketing operations produce losses in quality and quantity" in the case of Sri Lanka (2) (1981). Perhaps, as a result of the work of a few scientists in this area, today's climate appears quite conducive to increased research efforts at identifying the causal factors in paddy/rice P.H.LL more precisely, and for the quantification of such losses in relation to specific post-harvest functions. Such efforts have still not begun on a big enough scale in Sri Lanka, at least for the fact that the institutional base and the incentive system necessary for the conduct of such research has not so far been created (a point we elaborate on below).

Milling efficiency

A summary of some of the bits and pieces of research done recently in Sri Lanka on paddy/rice P.H.L. issues may begin with the suggestion that the minimization of P.H.LL must be associated with a closer dialogue between plant breeders and process technologists. A study by Jayaratne and Vellandi (3) (1978) indicates that paddy milling effeciency is affected not only by the "type" of processing adopted (raw or parboiled), but also by the "variety" of paddy as determined by genetic and other characteristics. "The rice outturn on milling of paddy depends on the variety of paddy, its condition and the processing conditions." Different varieties have different milling outturn rates. Yet, breeders, in their search for higher field yields of raw paddy tend to neglect the aspect of milling outturns. An integration of these disciplinary areas in looking at paddy/rice P.H.LL., alongside the simultaneous upliftment of the level of process technology in Sri Lanka, is called for.

A study conducted by Breckenridge (4) (1976) highlighted the relationship between parboiling and the improvement of milling recovery rates (and the quality of milled rice). When cost considerations (in parboiling) are introduced, however, the economic justification of increased milling recovery may have to be somewhat modified. The duration of "soaking" and in the "steaming" of paddy for improved milling recoveries (from parboiled paddy) were studied by her and shown to vary for different types and qualities of paddy. She too, has urged the need for reckoning these factors more objectively if we are to raise milling yields and enhance the quality of milled rice.

Palipane and Vellanki (5) (1977) studied further the importance of the length of paddy soaking time and the water temperature at which this cooking should be done for optimum milling results. They question the traditional practice of cold soaking and emphasize that P.H.LL can be minimized quantitatively as well as by qualitative improvements in the milled rice by adopting improved parboiling techniques. The Vellanki, Velupillai, Ramalingam and Wickremanayake study (6) (1977) adds further knowledge to the possibilities for cost reduction through improved parboiling techniques while maintaining existing quantity and quality considerations. De Silva's subsequent research (7) (1980) adds further evidence to the hot soaking and parboiling effects on milling outturns.

Nevertheless, in these days of steeply rising energy costs, the economic aspects of fuel become aspects of viability. It is in this context that one sees a gap in such research in that the economic aspects of such research are generally neglected. One needs to evaluate in all these cases whether the marginal costs of adopting technically superior methods are justified by the marginal savings in the physical and value products of the gain as a consequence of such innovation adoption. In any case, the viewpoint of a systems approach to P.H.LL research and preventive action which Dr. Illangantileke has emphasized in our discussions is, we believe, very necessary in a developmental context as is inter-disciplinary research that we have implied in the above statements.

Problems in storing

The problems of storing paddy and rice have also been examined at times by scientists in Sri Lanka. The traditional "on farm" storage technique of the "BISSA" was evaluated by Palipane at the RPDC (9) (1978). The study has shown promising results with this traditional method involving little produce losses, low capital, costs, a lot of complementary labour input (employment) and providing the farmer greater control over the timing of his paddy/rice sales. Palipane (RPDC) with Breckenridge (Central Agricultural Research Institute, Gannoruwa), are currently conducting a joint study measuring changes in the quality of rice grains and physical losses from insect infestation during storage in commercial warehouses.

Milling losses

Milling losses, too, have been the concern of some researchers. The traditional "hand pounding" of paddy technique was examined by Vellanki and Ramalingam (8) (1978) so as to evaluate milling losses. This study provides evidence for the need to introduce mechanical means, albeit simple "appropriate" technology, to minimize P.H.LL. in milling and for the improvement of quality. Undergraduates of the Department of Agricultural Engineering, Peradeniya University, have, under the direction of Dr. Illangantileke, recently measured the efficiency levels of different types of commercial mills in terms of the total yield and the amount of head rice obtained.

Lack of research incentives

The above are some of the efforts of researchers at analyzing problems impinging on P.H.LL. in the domestic production of paddy and rice. It is believed, however, that the extent of research into such issues is hardly sufficient; the body of knowledge built up is insufficient as a base on which sound policies could be mounted. It is to the credit of our few scientists, in this area,for developing even this amount of research knowledge given the facilities and the incentives provided. These research results are more the personally motivated and individual efforts of the various scientists hailing from several independent institutions such as the University of Peradeniya, the Central Agricultural Research Institute at Gannoruwa, and the Rice Processing Development Centre at Anuradhapura. There is no integrated effort in Sri Lanka at implementing a broad research programme focusing on a variety of issues related to the minimization of P.H.LL. in paddy and rice.

Problems of Rice Processing Development Centre

It is in this context that we propose to highlight herein the importance of the Rice Processing Development Centre (RPDC) at Anuradhapura. This Centre is a project which resulted from FAO/UNDP initiative. It was equipped

with various types of rice mills, parboiling and drying systems, threshing floors, storage facilities, a fully equipped laboratory for chemical research, classroom facilities, a library, an auditorium, hostel facilities, and staff quarters. It was established in 1976 to facilitate improvements in rice processing in Sri Lanka and implicitly,therefore,to study P.H.LL. prevention and minimization issues with regard to this major food item so crucial to the economy. Unfortunately, we in Sri Lanka have not yet learned to appreciate this FAO/UNDP project let alone to properly administer and manage it in such a way as to facilitate the process of economic development. Soon after the preparatory work in setting up this Centre was completed, we "lost" our foreign experts even before they were able to extend to us their advanced theoretical and practical knowledge of paddy and rice milling, storing, factory layout and other technical-technological issues, and even before we were able to grasp, as a society, how to define a course of action for a broad spectrum of useful research, and/or to train and activate our young scientists and other research personnel to take over the research and managerial functions of the Centre.

This research organization, the RPDC began as a subordinate arm of the government's Paddy Marketing Board (PMB) an institution responsible for price support. Unfortunately, the Centre has continued to remain a handmaiden of this PMB, and to serve the day to day parochial needs of this action oriented government organization which is regularly under pressure to achieve different targets and fulfil non-research related objectives. As a consequence, it has not been possible to develop within this Centre, a culture of research and experimentation into the post-harvest problems faced by farmers, millers, storage and warehousing concerns, equipment and machinery manufacturers, traders, consumers, and other participants in the paddy/rice industry. "Under-development" itself displays thus a tendency to create vicious circles of poverty and ignorance which tend to keep poor countries poor, indeed, as Ragnar Nurkse pointed out to us not so long ago !

Today, it has just one or two qualified Research Officers, One Engineer, a Technical Assistant and two Lab Technicians to deal with all the professional functions of the Centre. It lies woefully underutilized and apathetic without a cause and without direction. The development direction, as the Agricultural Development Authority (ADA) of Sri Lanka has seen in this context, is to remove this Centre from the management and control of the PMB and to set it up as an independent research organization with professional leadership and responsible for the independent study and evaluation of post-harvest problems pertaining to all grains and cereals. It should be led and directed by professional personnel having close liaison with the Universities, research institutes, and world and domestic R and D oriented organizations. It needs to be strengthened to handle the socio-economic aspects of post-harvest research issues as well with emphasis on "demand" and other "market" related dimensions to provide behavioural guidelines to technical research. For, the effectiveness of technological changes that can be adopted is closely related to what market conditions and human behavioural considerations would indicate.

Proposal for Food Science and Technology Institute

Another important developmental idea which the ADA has been promoting is the setting up of a Food Science and Food Technology Institute in Sri Lanka on the lines of the Indian and Thai models. P.H.LL.in Sri Lanka are highly related to the lack of sufficient scientific knowledge and capacities in regard to storing,processing,packing,packaging,preserving,etc. Until the scientific base in the areas of Food Science and Food Technology is built and the capacity created for a healthy appreciation and concern for "market" and "marketing" related aspects, the concept of the minimization of P.H.LL. in Sri Lanka is likely to remain a mere academic issue.

Intensifying interest in "demand' for food

Another view point we wish to present, and an approach the A.D.A. is vouchsafing, is to intensify, interest in the "demand" for food side of the equation in Sri Lanka's efforts at bringing about a reduction in P.H.LL. The attention today is heavily biased towards what economists refer to as the "supply" or the production, or technology related, side of the issue. Our plea is that if emphasis were shifted to the "demand" side, concern will be aroused towards measures to increase "real incomes" of consumers and for the better identification of consumer needs. The improved identification of consumer demands and patterns is likely to facilitiate the transmission of clear cut messages down the marketing channels about the intermediate functions that have to be performed, what products need to be produced, what needs have to be satisfied, what conversions have to be done, and so forth, in the profitable operation of food related business activities. Emphasis on the real income side calls forth attention on reducing the "real costs" of performing all the related functions from cultivation to final consumption, the one way through which buyer (real) incomes can be increased. Higher real incomes mean that significant increases in the demand for food are likely to be given high income elasticities of demand in our part of the world. P.H.LLreduction is likely to become profitable to all and sundry; it is a major avenue for reducing marketing costs. Especially if the concept of an "open market" economy were to be followed, as has been postulated as part of public policy in Sri Lanka, and there is a concommitant reduction in public sector controls and an elimination of trading restrictions on the private sector, business opportunities are liekly to rise. If P.H.LL. reduction becomes an area of profitable opportunities; one can predict with a high degree of confidence that whatever new knowledge is developped on cost reduction techniques it will be readily adopted and resource use economized on.

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no need to have mechanized craft and gear and no need to use fuel. This helps to keep the cost of production and market prices very low which can encourage consumers to purchase inland fish over the closest alternative which is sea fish.

Further, an inland fishing unit could comprise of only a few people; generally one or two members. Hence, it is easy to make amicable decisions and keep out problems such as disputes. The smallness can also help them to maintain their operational activities more regularly and confidently. These very reasons will enhance the entry of more small inland fishing units in places where basic conditions are favourable.

Again, compared to sea fishing the area of operation in each inland fishing unit is very small. Therefore, the provision of marketing facilities, of technical and advisory services are easy. Furthermore, smallness will be helpful in keeping them in touch with administration of credit and subsidies (various kinds of followup work and control). Hence, the advantage of smallness of an inland fishing unit can be helpful to both the administrators and the people.

Conclusion

It is clear therefore that the utilization of the Dry Zone tanks for inland fisheries may be helpful to generate more full time employment, as well as improve the rural economy, and help to uplift the nutritional status of the peasants. On the other hand these advantages listed above could provide a definite opening to the authorities to get a "quick start" on fish farming on a more intensive scale in the agricultural areas.

The development of inland fisheries, however, are directly connected to the achievement of the following goals:

(a) Popularization of inland fish farming and consumption habits, especially through the mass media and extension services;

(b) Encouraging people to enter this area by providing financial, technical and advisory services and;

(c) Promoting self participation in the development of domestic level as well as national level fisheries.

Advantages of Smallness

Compared to the marine fishing units, inland fishing units are very small. Generally the capital to be raised is low (for the enterpreneuer) in inland fishing, because of the smal smallness of craft and gear required and the high rate of subsidy granted by the Government on the total investment. There is also

(19) Some Sociological Problems of Colonization on a Peasant Framework, S. J. Thambiah, The Ceylon Economist, Vol. IV. No.3; 1958 Dec.

(20) Socio-Economic Survey of Elahara Colonization Project; Faculty of Agriculture, University of Ceylon, 1968.