

# Stemming Operation Flood

## Towards an Alternative Dairy Policy for India

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*The paper assesses ten central decisions taken under the Operation Flood programme, viz, to use donated dairy foods to generate funds for launching a 'flood' of milk in India, to introduce crossbred cows widely, to extend the cultivation of green fodder, to emphasise compounded cattle feed, not to prevent the export of concentrate residues from India, to supply cities entirely with milk from rural sources, to replicate the Anand pattern of dairy co-operative, to set up a national milk grid, and not to undertake special feeding programmes. These policy decisions are criticised, and an alternative dairy policy is sketched for India.*

### I Introduction

IT is now 17 years since India launched Operation Flood, also known as the white revolution, a dairy development project that can only be described as pathbreaking in terms of its scale, ambition and innovation. Two phases of the programme are over, and a third phase has now begun. This is not merely an opportune juncture to reconsider the project, it is a critical one. A period of almost two decades is sufficient to take stock of the suitability and impact of a development programme. Further, Operation Flood represents a break with earlier dairy policy in India and this is a suitable time to compare the merits of various strategies. International considerations also suggest reassessment. In the case of Phase Three of the programme, the European Economic Community (EEC) has for the first time hesitated over providing the commodity aid that is so crucial to Operation Flood,<sup>1</sup> and the likelihood exists of aid gradually being transmuted into trade. On the other hand, there is considerable talk of replicating Operation Flood in various Asian and African countries, and India should evaluate the programme, before passing it on to other nations.

The strong tide of praise and approbation which has accompanied the Operation Flood programme as been countered by a persistent backwash of criticism. Although the author of this paper is numbered among the critics, I would like to make clear at the outset that to me Operation Flood represents (a) a uniquely integrated approach to dairy development in India, (b) a committed and professional effort, and (c) a major developmental thrust. Indeed, it is because of these qualities that the programme provides a definite, coherent and clearly visible target for criticism. If an integrated, committed, professional and development-focused critique of the programme has emerged, it is mainly in response to these qualities characteristic of the programme and the organisations responsible for it. In this way, Opera-

tion Flood has stimulated the crystallisation of (what we feel is) a more appropriate dairy policy for India, if in a dialectical fashion by provoking antitheses to its theses. The programme has many important lessons to impart, even if these are negative ones. We, therefore, consider that Operation Flood could serve as a pathway to more effective dairy development, although necessitating a U-turn.

The history and organisation of the programme and of the associated agencies can be found in many other documents and will not be repeated here.<sup>2</sup> We propose in this paper to examine ten major policy decisions characteristic of the Operation Flood programme. We will explain why we consider these decisions to be undesirable and suggest modifications we hold necessary, with our reasons. The alterations which we suggest are not minor or piecemeal, but together cohere into an alternative dairy policy for India, one that we might call 'Operation Counter Flood'. This label does not denote any confrontational stance in relation to Operation Flood, or the organisations associated with the programme. It only summarises the somewhat opposite orientation of our alternative, and makes explicit the shift that we feel should now take place in Indian dairy policy.

### II

#### Donated Dairy Imports

It can be argued that the foundation stone of the Operation Flood programme is the acceptance as food aid of some surpluses of dried skimmed milk and butter oil from the EEC. The Indian Dairy Corporation (IDC) acts as a central agency handling these imported commodities, and sells them to metropolitan and city dairies to be recombined with locally procured liquid milk and sold to urban consumers. The sale of imported dairy foods generates most of the funds for the Operation Flood programme (in addition to a loan from the World Bank). The other aspects of the programme, which we shall discuss in later sections, are thus

dependent on this source of funds—although the other aspects can and will be criticised in their own right.

Conversely, this policy decision alone merits severe criticism, regardless of what activities are financed by funds derived from donated dairy commodities. Even if our own approach to milk production and marketing, so very different from that of Operation Flood, were financed in this manner, we would still oppose the generation of funds through the strategy of selling milk commodities donated by the EEC. There are a number of reasons for this.

Such funds create a dangerous substratum of subsidies, as has been demonstrated by one study of the Delhi milk market.<sup>3</sup> Dairy aid, as a cheap source of milk, gives Operation Flood's national dairy grid the financial leeway to pay for the expensive business of procuring and transporting milk produced in small quantities scattered over rural India, where road communication is poor and climatic conditions are adverse to the preservation of milk. If the imported commodities given free to India and sold cheap to Operation Flood dairies were not available as subsidy—if, for example food aid was stopped—the following chain of consequences would ensue. The heavy costs of procurement, preservation and transport would have to be borne fully by the national milk grid. The procurement price that this grid would be able to pay farmers would then fall, pushed down by overhead costs. This would lead to a decrease in the amount of milk procured by the grid, which would in turn push costs further up and procurement prices further down. The World Food Programme mission which evaluated Operation Flood in 1981 drew attention to these covert subsidies.<sup>4</sup>

Paradoxically, at the same time that gifted dairy imports subsidise procurement of local milk, the very availability of a source of milk cheaper than what Indian farmers can produce acts as an inbuilt depressant of the procurement price paid to local milk producers. The World Bank appraisal mission on Operation Flood II noted that the economic

price of milk recombined from imported commodities and including transport, storage and processing costs was equal to the then prevailing farmgate price of milk—and this local milk would then have to be transported and processed at further cost.<sup>5</sup> Similarly, the economic price of indigenously manufactured dried skim milk is significantly higher than that of the imported equivalent, even when produced in the country's most efficient dairies.<sup>6</sup>

Prior to Operation Flood, dairy commodities were imported on a commercial and not a gifted basis, but at that time only dried skim milk was imported and not butter oil. That situation represented an improvement over the present one, in that dried skim milk would have to be recombined with local milk. The additional import of butter oil means that it can if necessary be directly combined with dried skim milk, thereby bypassing local milk supply.<sup>7</sup> Further, under Operation Flood, butter oil has been sold as a cooking medium, allowing the seepage of food aid into markets other than that for milk.<sup>8</sup>

It can further be argued that generating funds through the sale of foreign donations of dairy commodities directs these funds to certain channels rather than others. For these commodities to be sold so that funds may be generated, investments have to be made in warehouses for storage, dairies with recombining equipment, vending outlets, and so on. The bias of the Operation Flood programme towards building market infrastructure rather than enhancing milk production has often been commented on,<sup>9</sup> as also its over-emphasis on hardware which the Jha Committee report drew attention to.<sup>10</sup> We suggest that this basis is to some extent inherent in the source of finance opted for by the programme. In fact, the IDC itself came into existence only in order to handle imported dairy commodities.

All these trends taken together point to the danger of India's organised dairy sector becoming dependent on imported commodities—first on donated imports and later (if the donors refuse aid) on commercial imports. That the programme has succumbed to this danger is clearly demonstrated by the fact that although Operation Flood promised to make India self-sufficient in milk by 1975, this has not been achieved even in 1987. Indeed, the persistent requests to the EEC for further commodity aid for Phase Three provides clinching evidence of dependency.<sup>11</sup> The ripples of this dependence have spread over the country in the course of the programme, for under Phase One only the four metropolitan cities made use of imported commodities but during Phase Two the recombination has spread to other cities and towns.<sup>12</sup>

A counter-argument could run thus: "So what if India imports dairy foods from countries which produce them more efficiently? Is not that natural and inevitable?" Had this argument been put forward two decades ago it might have held more credi-

bility, but following as it does on repeated promises of self-sufficiency and repeated failures to achieve this, it smacks of expediency masquerading as efficiency. In any case, such an argument cannot stand against considerations of India's limited reserves of foreign exchange, the priority that should be accorded to import of more essential commodities, the disincentive to local milk production that the import of dairy commodities would entail, and the sharp fluctuations in the price and supply of milk foods in the international market. The very 'rationality' and 'efficiency' of Europe's milk production can be questioned, given levels of over-production and surplus, and the fact that imports of cattle food into Europe are often from countries with undernourished cattle, with these very countries later importing dairy commodities from Europe. (India is one such country: see section VI.)

There is also the possibility of dependence in one sector of India's economy spilling over into other sectors. This possibility has already arisen in the case of oils and fats, as was evinced some paragraphs ago with reference to the sale of donated butter oil as a cooking medium. Apart from such subterranean seepage, the National Dairy Development Board which designed Operation Flood is handling a parallel programme with oilseeds, centring around the import of vegetable oil as a gift from North America. Vegetable oil has also been imported from the EEC under the Operation Flood programme itself, and the EEC while hemming and hawing over further dairy aid to India has declared itself interested in a 'flood type' project with vegetable oil.<sup>13</sup>

An alternative dairy policy for India must, therefore, contain this danger of dependence in addition to working on problems internal to the country's dairy economy. The first step should be a hard-headed assessment of the extent to which and the mechanisms through which dairy aid is subsidising the organised sector under Operation Flood. Next the contentious question must be addressed as to how these subsidies can be eliminated, and who is to bear the cost, whether the state exchequer, the urban consumer or the producer. We suggest that the guiding principle should be that those consumers who can afford to pay the actual market rate should do so (although in section X we later suggest strategies whereby the market price can be lowered), and that subsidised consumption should be restricted to deprived groups (see section XI). The recent EEC review mission on Operation Flood suggests in its report that the interest which accrues annually on the substantial financial reserves which the IDC has amassed through the sale of donated commodities could suffice to cover subsidies for an interim period until these subsidies are removed.<sup>14</sup>

Dairy imports have to be phased out, and those of butter oil before dried skim milk, for reasons already discussed. This will involve a stock-taking of present levels of

dependence on imported commodities in various urban centres. Limited levels of dependence should be eliminated and heavy dependence gradually reduced. The IDC's present stocks of dairy commodities, both imported and indigenous, should be directed towards these ends within some fairly definite time frame. At the same time the focus of dairy development activity must shift from Operation Flood's preoccupation with marketing systems to the enhancement of milk production (within the limits stipulated in section III), as a positive thrust towards self-sufficiency and against dependence.

The political implications of stopping dairy aid are quite major. Nonetheless, we believe that it may be possible to present the wider context and the need for unpopular measures to the urban consumer who will be most affected by them, through an intelligent and persuasive public awareness campaign in the national media.

### III Milk Production Targets

The very title of the Operation Flood programme suggests ambitious milk production targets, and it is in order to intensify milk production sharply that the programme advocates the technology of crossbred cows, green fodder and compounded cattle feed. Although in its implementation the programme has neglected milk production activity, as discussed in the last section and later on in this section, we shall here examine the (over)emphasis on dairy production evident in the design of the programme. We shall question whether a flood of milk can be generated in the present Indian situation and draw attention to some tight constraints on milk production in India.

It may be argued that the proposed exercise is quite irrelevant, since Operation Flood has achieved spectacular increases in production: "Milk production in India has gone up from 223 lakh tonnes in 1971 to 346 lakh tonnes in 1982-83" [IDC: 1983, 18]. These claims can be countered quite convincingly by pointing out that sudden increases in milk production are not so much actual as apparent, since it is only quite recently that the methodology for assessing milk output has stabilised and thus milk production in earlier decades are substantially underestimated.<sup>15</sup> It has also been shown that the increases which has taken place can be attributed to milch buffaloes fed on agricultural residues and not (as envisaged by Operation Flood) to crossbred cows efficiently converting green fodder.<sup>16</sup> Since the Jha Committee makes it clear that even in the 1980s the programme's supply of technical inputs to the producer was unsatisfactory, we can question how the output of milk increased without the necessary supply of inputs. Finally, if these stupendous increases have indeed taken place because of the programme, why does Phase Three need the additional commodity aid from Europe that the implementing

agencies and are pleading for...  
The first constraint we draw attention to is agro-ecological, since climatic conditions of extreme heat and humidity/aridity are not ideal for dairy production. The second constraint is socio-ecological, with India supporting one-fifth of the world's people and almost the same proportion of the world's cattle on one-fortieth of the global land-mass.<sup>17</sup> This straitened situation demands that land be used to feed people directly through the production of cereals, pulses and vegetables, 'rather than' indirectly through the conversion of agricultural produce by animals into meat or even milk. The third constraint is socio-economic, since approximately half of India's population does not at present get enough of foods more basic than milk, such as staple calorie. (It should be noted that these same constraints render inappropriate Operation Flood's milk marketing strategies, a point which we elaborate later.) Were India's social ecology and social economy different, agro-ecological constraints could be overcome through such technological devices as air-conditioned cowsheds, as in the warmer parts of the US.

The flood of milk produced in Europe (which is now creeping into India's dairy economy) is generated under diametrically opposite conditions of a temperate ecology where a small population enjoys a level of income and a standard of living which permits intensive consumption of high quality foodstuffs. The irony is that it is from this environment, so different to that of India, that Operation Flood imports its milk production strategies.

We would, on the other hand, suggest that instead of indiscriminate import of dairy technology from temperate zones, efforts be directed towards enhancing the efficiency of tropical dairying systems. Rather than blindly copying the technology of thinly populated societies, we should continue India's age-old subordination of dairying to agriculture, with milk production complementing the cultivation of foodgrains, so that the two processes can expand together and not at the expense of each other (as in Euro-American dairy farming which is resource-intensive). The ambitious objective of flooding India with milk should be replaced by more modest aims of a gradual and steady increase in the present trickle. Emphasis should not be laid on enhanced production alone but as much on equitable distribution,<sup>18</sup> so that those for whom milk is a vital food, such as small children and pregnant or lactating women in poor homes, have some access to what milk is produced.<sup>19</sup>

In the following sections of the paper, we work out the concrete implications of these suggestions.

### Crossbreeding Strategies

The white revolution envisaged that a flood of milk will flow from a changed unit

of production, not from low yielding native stock, but from crossbred cows with European sires and Indian dams. These hybrid cows are to constitute the large part of a national milk herd. European breeding stock include the Jersey, Holstein-Friesian, Brown Swiss and Red Dane, and their semen will be disseminated in liquid or frozen form, through artificial insemination. Some attempts have even been made to introduce purebred cows of these strains into parts of the country,<sup>20</sup> and indeed to transfer to India some of Europe's surplus cattle earmarked for culling.<sup>21</sup>

A preliminary objection to the crossbreeding policy is that a general attempt to increase the dairy potential of India's cows is premature, since their present potential is under-utilised as a result of inadequate nutrition. Secondly, such a policy interferes with the present division of labour within the bovine species in most regions of India, with the she-buffalo specialising in the production of milk, and the zebu cow specialising in the production of bullocks to provide animal power for draught and other purposes. Thus, if the crossbreeding policy were successful, India would have two specialised milch animals but no good source of animal power, since the male progeny of crossbred cows tend to have less strength, speed and stamina than native bullocks (although crossbred bullocks require a superior diet).<sup>22</sup> The need for draught animals cannot be exaggerated in a country where bullocks meet two-thirds of power requirements and where widespread tractorisation is not feasible. The implementation of Operation Flood's crossbreeding policy in areas noted for the production of various breeds of draught bullocks is thus a matter of some concern.<sup>23</sup>

There are other serious arguments against the crossbreeding programme. One is the discomfort experienced by crossbred cows under conditions of heat and/or humidity which can significantly depress their output of milk. These bovines are also easily susceptible to various incapacitating diseases carried by air, water and insects, in a country where most owners cannot insulate their cows from these dangers or afford expensive veterinary aid, which in any case is not available in many areas.<sup>24</sup> (It has also been suggested that setting up the extensive veterinary infrastructure required for crossbred cattle will create another profitable sphere of operation for multinational corporations and for Indian monopoly houses.)<sup>25</sup> The dietary demands of crossbred cows are far greater in quantity and superior in quality to those of local animals, and would further strain India's precarious food situation. If this level of feeding cannot be maintained, crossbred cows will not fulfil their yielding potential and the very purpose of crossbreeding will be frustrated.<sup>26</sup> Since crossbred cows are high yielders but expensive and risky to maintain, they are more suited to the requirements of largeholders and medium farmers than to the small/

marginal cultivators or landless labourers who exigently need a source of income. Indeed studies show that differences in milk yield and returns from milchstock owned by farmers of various socio-economic categories are greater in the case of crossbred cows than buffaloes or zebu cows.<sup>27</sup>

Even if none of these other objections held, the very fact that crossbreeding strategies require an extremely complicated and costly infrastructure would suffice to question their feasibility. In a country that is large, poor and unable to provide electricity, water and roads to many villages, are the resources available for the complex network of transport, preservation and timely application required for an input as fragile as the semen of breeding bulls? It is no wonder that the success rate of artificial insemination is unimpressive. Further, the breeding policy does not include the necessary details of what level of exotic blood of which particular European strain is to be used for various kinds of cows in diverse regions of the country.<sup>28</sup>

We suggest that the general breeding policy should not be one of crossbreeding, and that the crossbreeding programme be limited to areas where conditions prevail which are necessary for its viability, such as places of high altitude, situations of urban and peri-urban dairying, and states such as Kerala. We cannot emphasise too strongly that cattle breeding policy should be sensitive to regional diversity and must safeguard the draught power supply of the country. One such safeguard would be to recognise the she-buffalo as Indian's main milch animal (though allowing for interregional variation), with proportionate investment in enhancing her performance, encouraged by the presence in the sub-continent of the world's best buffalo breeds.<sup>29</sup> In this manner, the cow's contribution of work bullocks to the economy will not be subordinated to milk production. The zebu's dairy potential should not be neglected but can be developed by exploiting the tropical breeds for which India is famous, and which include dairy strains in addition to dual-purpose breeds that combine strong bullocks with cows which yield well. It should be noted that many of these tropical breeds originate in semi-arid areas of the country and are thus capable of withstanding harsh climatic conditions and disease at the same time that they are able to operate on low grade fodder.<sup>30</sup> Attention should also be paid to subsidiary milchstock such as goats, camels and asses since each makes a unique contribution to the dairy economy.

Official breeding programmes should enlist the skills of traditional breeders who have maintained the quality of tropical breeds (and whose ancestors developed these breeds). Indigenous institutions like gaushalas should be more effectively harnessed by breeding strategies, as was attempted in earlier five-year plans.

## V Green Fodder

Since dairy policy should devote considerable attention to the input of feed and fodder, in the following three sections we shall discuss the policy choices made in this regard by Operation Flood, beginning in this section with the programme's emphasis on increasing the acreage under green fodder. Indeed this choice of feed input is a concomitant of the choice of production unit that has just been discussed, for crossbred cows require a substantial amount of green fodder in their diet in order to realise their high yields. The corollary of this relationship is important. If we discover compelling arguments against an expansion of the area under green fodder, those arguments will accrue to those earlier put forward against widespread crossbreeding of zebu cows.

The cultivation of green fodder requires considerable resources of land, water and fertiliser, which are fairly easily available in the temperate regions with low population from which Operation Flood borrows its dairying strategies. In India, land resources are already heavily exploited, supporting both a large human and large livestock population. Water is also a scarce resource, and an unreliable one in many parts of the country which are wholly dependent on erratic rainfall. Fertilisers is similarly an expensive input which is available in limited quantities. Are we then going to divert prime irrigated land and significant amounts of fertiliser from the production of food crops in a country with shocking statistics of malnutrition, or from the cultivation of more essential cash crops?

These techno-economic arguments against a heavy emphasis on green fodder in dairy policy are buttressed by socio-economic considerations. The 'white revolution' promised a productive process which was not land-based as an alternative source of income for those with little land or none at all, as a means to bypass the obstacles to land reform. However, a policy that links milk production to large inputs of green fodder thereby links it also to the ownership of irrigated land in sufficient quantities to spare for the cultivation of this fodder. Such a policy is then a 'white reaction' biased against producers with inadequate or no land resources, who for this very reason require additional income from dairying.

Especially alarming are the efforts under the Operation Flood programme to take over communal grazing land in villages for the cultivation of green fodder (as has been done in Kaira district and some other parts of Gujarat).<sup>31</sup> Village grazing grounds are undeniably overused and degraded, but at least those without land have access to them, and it can be argued that it is this access which sustains milch animal ownership among the rural poor.<sup>32</sup> Further, it is the ever-increasing density of human and livestock populations in twentieth century India

which is responsible for the overexploitation of communal land, not any innate irresponsibility on the part of rural populations, since archival documents allude to traditional conservation of grazing land through systems of rotation.<sup>33</sup> By commandeering grazing ground to grow green fodder, Operation Flood is cutting off the major source of free fodder to which the rural poor have access, and replacing it with an ingredient which cannot be efficiently converted by the low quality milchstock typically maintained by the poor. However, this use of communal land benefits the more affluent in the village who can afford to buy green fodder and who own high-yielding milchstock capable of efficiently converting such fodder. Large and medium landholders are thus provided with a source of green fodder in the village in addition to their own land. We agree that measures are urgently required to improve rural grazing lands, but such displacement of the poor from them is not acceptable.

Our alternative policy, therefore, would not suggest any sudden expansion of green fodder cultivation from the four per cent of India's land that it occupies.<sup>34</sup> At present, the country's agro-economic traditions wisely subordinate the growing of green fodder to the production of food crops and cash crops, either as one stage in the rotation of crops, or on the periphery of fields where other crops are growing, or in rows between these other crops, or in seasons when food/cash crops cannot be grown. Such strategies merit encouragement, in order to produce green fodder along with and not instead of more important crops. Similarly deserving of encouragement are efforts to grow green fodder in city cattle colonies by exploiting the availability of manure and the water used to clean sheds (as reported of the Aarey Colony).<sup>35</sup>

Other indigenous strategies to be reinforced include the thrifty and resourceful mustering of green fodder through cutting grass from roadsides, wasteland or wherever it is available, and through using byproducts of food/cash crops in the form of leaves, stalks, the green tops of sugarcane, etc.

Unlike Operation Flood's stress on green fodder which would result in competition for agricultural resources between people and milch animals, our alternative emphasises the complementarity between the diets of humans and milchstock. It also lessens the bias of dairy policy against the rural poor by encouraging strategies which are labour intensive rather than capital intensive.

## VI Compound Cattle Feed

Another input of milchstock nutrition that Operation Flood lays stress on is factory compounded cattle feed, the manufacture of which has been substantially extended under the programme.

We question the widespread relevance of

such a purchased input of feed in India, where the price of milk is determined by the norms of subsistence agriculture rather than commercialised dairying. At present, no major emphasis can be placed on compounded feed in dairy policy, since its use would be limited to specialised milk production, whereas the general situation involves dairying as a supplementary activity to agricultural production and this relationship should not be drastically altered given the food requirements of the country.

As in the case of green fodder, the stress on compounded cattle feed biases the Operation Flood programme against the interests of poorer producers who cannot afford to use purchased inputs in dairying and who depend on agricultural waste and on what can be gleaned through various labour-intensive activities. It is the milk producer with a larger resource base who has spare cash to invest in such conveniently processed nutrients for milch animals.

Further, there is a likelihood that the industrial manufacture of cattle feed will draw upon substances that are edible by humans, a danger that cannot be overstressed in a country where malnutrition is widespread. Already there are suggestions to use cheap millets and low grade pulses as cattle feed.<sup>36</sup> The consequence would be increased prices and decreased availability of these commodities, and would hurt the large segment of the population whose purchasing power cannot extend beyond such millets and pulses.

It can also be argued that India's scarce industrial resources should be used judiciously and optimally. Many existing cattle feed plants function below capacity, with authoritative sources putting the average capacity utilisation at 40 per cent.<sup>37</sup> Unsatisfactory levels of quality control are illustrated by the presence of toxic materials in 40 per cent of cattle feed samples collected from Gujarat (the state that is Operation Flood's show-piece of dairy development) and point to other hazards of the policy.<sup>38</sup>

An alternative policy of dairy development would, therefore, not lay strong emphasis on compounded cattle feed. Further, it would reassess the cattle feed plants included in the Operation Flood programme which are in the planning or construction stages to check if these plants are necessary or viable or need modification. A similar stock-taking would follow the functioning and capacity utilisation of cattle feed plants already in operation. Strict quality control measures would be established in the interests of animal health. Most important, the use of ingredients suited to human consumption would be vigilantly discouraged. We would also explore the option of processing byproducts and residues into cattle feed compounds through systems which utilise human labour, rather than machinery, in order to provide employment, particularly to rural women who are experienced in such processing activity.



## VII

### Export of Concentrate Feed

We have already questioned the suitability of Operation Flood's weighage towards green fodder and cattle feed compounds with regard to animal diets, and will now proceed to an act of omission rather than commission under the programme. At no point during the last seventeen years have the project authorities made any effort to prevent the export of concentrate residues from India to be used as cattle feed in other countries, nor have they even protested against this export, some of which was to EEC countries to produce milk that was later brought in commodity form to India. Computation of the quantum of this export vary from one-fifth to one-third of India's total concentrate residues, but there is no doubt that a significant drain of oilcake extractions takes place.<sup>39</sup> It can be argued that were these concentrates retained and used in animal diets, the country's milk supply would expand considerably, and some even maintain that the additional milk so produced would exceed that presently imported in the form of EEC commodities.

Be this as it may, there are compelling arguments against the export of concentrates from India. The country's milch animals do not actualise much of their yield potential because they are underfed. If their nutritive intake is enhanced, milk yields will increase. Given this situation, it is strange and ironic that valuable feedstuffs are exported. What is more, if the concentrate feeds now exported were available to supplement the straw and roughages which constitute the present staple diet of Indian milchstock, these inferior ingredients would be more efficiently converted into milk. In this way, conversion of even the low grade fodder left in India is adversely affected by export of concentrates. Further, such export diminishes the availability of concentrate feeds within the country and consequently increases their price. This has obvious implications for the cost of milk production in India. It also means that the access to concentrates of poor producers in particular is decreased by exports which lessen availability and inflate price.

A counter-argument could hold that the export of oilcakes provides India with valuable foreign exchange.<sup>40</sup> However, the sums involved do not seem of any critical significance. Also, if foreign exchange alone were the criterion, rather than internal considerations, we should not stop at export of cattle feed but should export everything that is exportable. Moreover, since our alternative policy emphasises indigenous strategies, large amounts of foreign exchange would not be spent on western consultants, European breeding bulls and the like, and the exchange lost through preventing concentrate exports could be more than compensated for.

Thus our alternative policy of dairy

development would include a phasing-out of the export of concentrate feeds from India, through a series of carefully considered and appropriately timed stages. For example, it has been argued that the profitable sale of oilcake abroad supports efficient extraction of edible oil, which might not be possible were this export stopped.<sup>41</sup> The basis of this argument requires careful examination, as do possible solutions, such as the provision of tax concessions to the firms involved in order to balance decline in profits when exports cease. The costs and benefits of decentralising oilseed processing in order to widen the availability of residues also need to be weighed.<sup>42</sup> Further, the direct use of oilcake in human nutrition requires examination.<sup>43</sup> We believe that stopping the export of concentrates would have an immediately beneficial effect on the country's dairy economy, by expanding the supply and decreasing the price of this crucial ingredient of milchstock diets.

## VIII

### Rural Milk for Urban Areas

Cities represent central areas of demand for milk at the same time that they are removed from agricultural production. Operation Flood policy embodies strategies to carry milk from villages to cities through a national milk grid of procurement, preservation, storage, transport, and distribution facilities (to be discussed further in the next three sections). The first phase of the programme explicitly included the objective of removing city cattle. However, this objective was itself removed when it proved infeasible, and it was argued that 'capturing' the urban market through an organised channel of rural milk would itself result in the elimination of city herds.<sup>44</sup>

We oppose Operation Flood's reliance on rural herds for a number of reasons. At present much of the milk produced in India is a byproduct of agricultural production as dairying is supplementary to agriculture. This subordinate relationship will be altered if rural areas have to provide towns with their *entire* requirement of milk. Dairying will then be no longer a byproduct industry but will become a specialised commercialised activity which competes with agriculture for inputs, instead of as at present using the wastes of agriculture as inputs. Such an alteration would be undesirable, since producing more milk would mean producing less food, in a country with grave levels of malnutrition.

Further, as result of its status as a side activity to agriculture, milk production in India proceeds on a small scale in scattered rural households. Collecting these small amounts of milk entails an elaborate procurement mechanism, against the background of rural India's poor and often non-existent roads. There is the further complication of the perishability of milk in a tropical climate, especially when carried over long distances

and bad roads, which necessitates expensive preservation measures. All these factors result in high overheads when rural milk is transported to cities. These overheads reduce the price received by the village producer (a matter of particular concern to small producers), and inflate the price charged to city consumers thus placing milk beyond the means of many urban residents. Rural-urban milk grids may be efficient in temperate climates where large amounts of milk are generated, but the comparatively small quantities of milk available in rural India militate against the economies of scale inherent in the logic of such a grid, and often lead to deficits in its financing which must then be borne by the producer or the consumer or the state or all of these.<sup>45</sup>

Moreover, carving long distance channels between rural producers and urban consumers allows the magnetic pull of urban demand for milk to more easily attract milk from villages. To the extent that milk thereby becomes less available and more expensive in rural areas, nutrition in these areas will suffer. More specifically, rural households with excess milk will no longer turn their surpluses into ghee once an outlet for fluid milk becomes available. This in turn will stem the supply of buttermilk, the nutritious byproduct of ghee manufacture, which was formerly available free or at a cheaper price than milk to those in the village without milchstock. Of special concern are the small households with resources sufficient to support a milch animal, but not sufficient to withstand the need to sell the milk produced for cash rather than keep some milk for home consumption, since it is in such producer households that nutritional levels are likely to be low particularly among women and children.

The alternative dairy policy that we propose would continue the Indian tradition of supplying the cities with milk from a number of sources, and not any single source, in order not to strain that source beyond desirable limits. Further, given the social ecology of India, a diversified procurement network to provide milk to cities would spread out the pressure of urban demand, and would provide insurance in case of decline in supply from any one source as a result of erratic rainfall, epidemics or such contingencies.

In our alternative, villages would continue to supply cities, exchanging their surplus milk for additional income. However, these villages should be located in sufficient proximity to cities to enjoy a good procurement price for milk without the costs of long distance transport and preservation cutting too sharply into this price. We must further distinguish between villages close enough to cities to allow milk to be carried without treatment, and those more distant which will require some preservation of milk before supply to cities, yet not so distant as to increase overheads unduly. Villages with surplus milk in interior areas can contribute

to urban dairy requirements (and benefit from urban demand) by supplying ghee instead of fluid milk, since ghee is much less expensive to handle, and since the byproduct buttermilk will remain in the villages for local nourishment.

However, unlike Operation Flood, our alternative policy will emphasise several other sources of milk for cities. Quite contrary to the programme, we would not seek the expulsion of city milch herds but instead would suggest their recruitment and reorganisation. For example, urban cattle colonies on the lines of Bombay's Aarey Colony would minimise the disadvantages of city milk production at the same time that it maximised the advantages, namely specialised and intensive production as well as low marketing overheads. Rural areas contiguous to cities could also specialise in dairying, since transport and preservation costs would again be low, with a beneficial impact on both procurement and retail prices. Another source of milk for urban areas would be the usually nomadic groups of herders and breeders, since their skills generate considerable amounts of milk, especially if cities or towns are near the waste or forest land where such groups operate.<sup>46</sup>

## IX

### Anand Pattern Co-operatives

One of the institutional forms embraced by Operation Flood policy—indeed, very tightly embraced—is that of the Anand pattern co-operative. In fact this attachment can be viewed as umbilical to the extent that the agencies which designed Operation Flood and implement it emerged out of the prototype of the Anand pattern, viz, the Kaira District Co-operative Milk Producers' Union Ltd (KDCMPU), located in the Anand taluka of Gujarat.<sup>47</sup> Thus, the policy decision examined in the previous section, namely to depend on rural sources of milk alone, is extended by the further specification that this milk should be channelled through co-operatives structured on the lines of the KDCMPU.

Further, while most institutional forms depicted by Operation Flood are technical in nature, such as the chilling plant or the feeder balancing dairy or the bulk vending outlet, the Anand pattern co-operative represents a human institution and a participatory one, and as such merits even closer examination. Yet, the approach of Operation Flood's policy to such participatory institutions is typically technocratic, embodying the view that co-operatives and other human organisations can be mass-produced and standardised!

While urging Anand pattern co-operatives on the rest of India, Operation Flood policy appears to lack an adequate grasp of the actual situation in the Anand area. To take only basic technical issues, the KDCMPU's success derives from buffaloes fed on agricultural residues whereas the Anand pattern described in Operation Flood docu-

ments emphasises crossbred cows and green fodder. What is more, certain features of the KDCMPU do not accord well with current national ideals. For example, despite claims that Anand co-operatives topple caste barriers, the success of the KDCMPU derives to a considerable extent from the activity of a particular caste group, the patidars, with some consequent negative effects for members of other and lower castes such as the ex-untouchables. Replicated Anand co-operatives have often been described as strongholds of locally dominant castes, thus reinforcing their power.

Replicating the Anand situation can also be questioned on the grounds that replication is unlikely of success, since, very specific and special conditions were responsible for the emergence and consolidation of the KDCMPU. These conditions include an exceptionally abundant supply of milk, access to the Bombay market which was organised to an extent unprecedented in the country, producers unusually unified through caste solidarity into opposition against middlemen, situational advantages in newly independent India, the patidar caste's network of influence, and substantial aid from within and outside India as the first co-operative of its kind. Even singly, these conditions are not typical of most of India, let alone in the needed configuration.

Again, the official patronage of the Anand pattern seems unfortunately to be combined with hostility towards other institutions in the country's dairy sector which have achieved a certain amount of success, such as the Aarey cattle colony in Bombay (discussed in the preceding section) or the Choryasi Taluka Co-operative Milk Sale Society Ltd in Surat. We, therefore, fear that not only will an institution adapted to the local context of Anand prove unsuitable in other parts of India, but that the official zeal in propagating Anand pattern co-operatives may displace or damage institutions that have evolved in those localities, or may stifle the initiative necessary for locally appropriate institutions to emerge. Would the KDCMPU have been born in the 1940s if a policy of imposing a model from above had been operative at the time?

When devising an alternative to Operation Flood, we would carefully investigate the reasons for the KDCMPU's success, to determine which of its features are amenable to replication and suited to the wider objectives of dairy policy. For example, the thrifty husbandry through which farmers at Anand combine dairying with agriculture perhaps represents indigenous systems of milk production at their best and well deserves emulation.<sup>48</sup> Similarly, the quality of veterinary aid provided in the area and the speed with which it is available would undoubtedly benefit other parts of India as well.<sup>49</sup>

All the same, policy which draws on the Anand experience is not the same as a policy which is obsessed with Anand (and Anand wrongly perceived at that, as in the case of Operation Flood). We would, therefore,

abandon as infeasible and undesirable the present strategy of 'replicate Anand at all costs'. Instead, we would aim at a broad, open and flexible use of co-operative institutions by dairy policy, in a perspective of 'Anand and other institutions' rather than 'Anand or...'. We would scrutinise all viable and smoothly functioning dairy institutions in order to note what lessons can be learnt from them, such as the Aarey colony's organisation of city cattle and the Choryasi co-operative's provision of credit to producers and its shearing of costs which benefits both producer and consumer, to take only the examples which have already been mentioned.<sup>50</sup> Our policy design would try to encourage and nurture local enterprise and initiative, and to build upon informal patterns of co-operation that already exist, rather than superimpose any uniform pattern on the whole country. We would experiment with forms of dairy co-operative which attempt to overcome the problems of deprived and powerless groups in Indian society, such as the pilot project by a voluntary organisation which aimed at co-operative production of milk (and not only co-operative procurement as in the case of the Anand pattern).<sup>51</sup> We would also seek to implement the concept and model of ghee co-operatives that was outlined in a policy document which appeared soon after independence.<sup>52</sup>

## X

### National Milk Grid

In this section we will develop some of the points that have already been raised in order to integrate them more closely into our discussion. The major thrust of the Operation Flood programme has been to set up a national milk grid which links the rural milk producer to the urban consumer through milk tankers, chilling stations and feeder-balancing dairies. It has been pointed out that the programme allocates more money to marketing structure than to production enhancement, and has at times exceeded estimated expenditure on the milk grid while failing to reach targets of disbursement on the milk production side.

Some of the objections which we have already put forward against Operation Flood policy have relevance here again. The milk tankers which link the grid require smooth roads as in the affluent countries which are being imitated, although many parts of rural India have no roads at all. If tankers are widely put to use, they will require frequent and expensive repairs, with consequent increase in marketing overheads; further exacerbated by the deterioration of milk in transit over rough roads, and by the ever-escalating price of diesel oil.<sup>53</sup>

Since milk sours quickly under tropical conditions, preserving milk during its long journey through the grid becomes a costly and risky business. Even the simplest techniques of chilling milk are problematic and expensive, because in many areas the water re-

quired in the chilling process (and even for the basic purpose of keeping containers clean in order to prevent spoilage) is a scarce resource, and the price of ice increases rapidly. These factors, like the problem of roads already discussed, suggest the need for fundamental development measures to precede the introduction of high level technology, as well as the injudiciousness of transferring technology to rural India from countries where ample infrastructural facilities exist. Again, milk production in India is characterised by sharp seasonal fluctuations, because of its relationship to agriculture which in turn is dependent on an unreliable monsoon in most parts of the country. The dairy plants that are part of the national milk grid thus swing uneconomically between underutilisation in summer and overutilisation in winter.<sup>54</sup> Feeder balancing dairies, introduced as a solution to seasonality, have themselves turned into a problem with their average capacity utilisation placed as low as 32 per cent in 1983 by the Jha Committee. The diseconomics of wasted scale are aggravated by the high cost of manufacturing dried skim milk (itself considered necessary to cope with summer shortages of milk) which is significantly higher than the price of imported milk powder.<sup>55</sup> The additional problems created by the scarcity and increasing prices of inputs such as furnace oil underline the unwisdom of a general industrialisation of the dairy market. We must criticise the design of Operation Flood's milk grid on the grounds that it is capital- rather than labour-intensive—in a country which has limited capital but much unemployed labour.

Our suggestion, therefore, is that Indian dairy policy should relinquish at least for the moment its dream of a national-wide industrial milk grid, because such a dream will only materialise when there is sufficient surplus milk as well as spare finance for investment. We would question whether the areas in the country which are at present considered surplus in milk, such as Gujarat, are really so, given the level of protein malnutrition among children in these areas.<sup>56</sup> Further, we have commented earlier on the general undesirability of financing dairy development in India through the sale of dairy commodities donated by the EEC, and specifically on the use of this finance to build up marketing infrastructure rather than to expand milk production. If indigenous supply proves inadequate in feeding the greatly expanded processing infrastructure, it may well transpire that what has been created is an international milk grid through which European surpluses are transferred to India, but this time on a commercial basis.

We do not advocate any total de-industrialisation of milk marketing in India, but that industrialisation should proceed on a discriminating and limited basis. Fluid milk plants, feeder balancing dairies and product plants should not be set up in the somewhat prodigal manner of Operation Flood, but

only where capacity will be efficiently utilised. We, therefore, propose that all dairy plants which are in the blueprint or construction stages should be ruthlessly reassessed for viability.

We would further argue that dairy marketing in India must be better oriented towards lowering overheads in order to benefit both producers and consumers. One means to this end would be to emphasise the use of labour rather than capital, a strategy with additional advantages in a country where employment levels (and thereby, income levels) need considerable boosting. For example, under Operation Flood indigenous dairy foods are being manufactured with industrial technology. We would instead advise that these foods be produced by women in a workshop situation which extends the kitchen technology that they are habituated to, and through which such products have traditionally been manufactured.

As has been already discussed earlier, haulage of milk from villages to cities should take place only over distances where the overheads do not depress producer prices unduly and inflate consumer prices undesirably. The dairy surpluses of remote areas could travel inexpensively to centres of demand in the form of ghee. Motorised transport should be used only where it proves economical, since intermediate technology of bicycles or animal-drawn carts can cover reasonable distances over existing roads. In order to minimise the need for pasteurisation, milk should not as far as possible be carried in fluid form across perishability barriers. Pasteurisation is not only expensive but to a great extent duplicatory, as the Indian consumer invariably boils milk, even pasteurised milk. This universal Indian habit could be relied upon to eliminate bacteria, rather than any industrial process. We should add that the strategies described in this paragraph are not novel or untested, but are used effectively and economically by the private trader, and bear emulation. Similarly, the 'loose' sale of milk by private traders helps those who can afford only very small amounts of milk, unlike the industrial grid's distribution in standardised packs or through bulk vending outlets.

## XI

### Milk Consumption among Vulnerable Groups

Our focus here will be on an act of omission by the Operation Flood programme rather than the acts of commission discussed in most sections of the paper. The white revolution began with slogans of milk for everyone, truly revolutionary in a land where milk is scarce and expensive and its consumption closely correlated with income levels. Later on, when these slogans proved difficult to live up to, the Operation Flood policy shifted its stand to argue that even if milk consumption had not increased among poorer groups, the sale of milk provided in-

come to small producer households which could then invest this income in cereal foodstuffs, to meet basic calorie needs that are widely unfulfilled and which take priority over protein requirements.

However, the programme makes no special efforts to distribute milk more equally, or to channel some milk towards those most in need of it yet least able to afford it (the vulnerable groups to whom we shall return later). This is a grave omission in the Indian context, where what milk is produced is quite inequitably consumed both within and between areas. For example, the per capita intake of milk in metropolitan cities is double the national average and even triple that in part of rural India, yet even so in an affluent metropolis like Bombay, half the residents cannot buy a third of their requirements of milk, and 14 per cent cannot afford milk at all.<sup>57</sup>

Not only is such inequity disturbing in itself, but the consideration that some amount of animal protein is required in all diets implies the need for wider distribution of milk, for in India meat as a source of animal protein has limited relevance given the optimal use of strained agricultural resources to feed a burgeoning population, and also given vegetarian norms.<sup>58</sup> These nutritional reasons aside, India is a land of lactophiliacs, where milk is a food for which most people have a strong positive bias, and thus access to milk should be extended.

In this situation, where all Indians want milk and need varying amounts of it, special attention should be paid to those who need it most for essential physiological functions, namely children under five-years of age and women who are pregnant or lactating, and in particular such women and children who live in deprived homes with precarious nutritional standards.<sup>59</sup>

The Operation Flood programme has been somewhat callous in this regard. Its boast that milk is no longer rationed rings hollow, since the need for rationing continues in order to spread a scarce yet desirable commodity more equitably. Little effort has been made under the programme to stimulate consumption among poor and vulnerable groups. Although a substitute for milk, "chaisathi", has been marketed in the low income areas of one city, this minor programme does not come to grips with the nutritional necessities of those inhabitants of such areas who need milk and not a substitute, neither has it been extended beyond the areas where it was introduced as a pilot project.

To compound this neglect of the poor, many strategies espoused by the Operation Flood programme have served to decrease the availability of lactic nutrition at the same time as they have inflated its cost. Some of the fluid milk procured by the national grid might otherwise have been converted into ghee, releasing buttermilk for local consumption. We are particularly concerned about the suction force exerted by the national milk grid on small producer house-

holds, among whom distress sales are common.<sup>60</sup> The inefficiencies of the grid, discussed earlier, decrease the procurement price that the producer receives<sup>61</sup> and thus (counter to the arguments of Operation Flood) his ability to purchase other foodstuffs. At the same time these inefficiencies push up the price paid by the consumer and thereby restrict the number who can afford to purchase milk. It has been suggested by a senior agricultural economist that the surpluses of milk which Operation Flood flaunts really represent milk that people cannot afford to buy<sup>62</sup> (and this is despite the present element of subsidy provided by donated dairy foods, as described earlier). The milk products that the programme has generated are impressive in their range and quality, but relate only to the incomes and lifestyles of the elite.

Our view is that a dairy policy for India should be as concerned with the equitable distribution of milk as with stimulating production. Therefore a dairy policy should be integrated and articulated within the wider framework of a food policy for India, ensuring for example that the production of milk complements rather than competes with the generation of other foodstuffs. More specifically, dairy policy should be framed within a protein policy. Thus, instead of Operation Flood's blanket approach to dairy nutrition, a protein map of India should be drawn up to demarcate areas where milk is the main source of protein and where fish/eggs/meat are not generally consumed. Special attention must be paid to poorer homes, and particularly to small children and pregnant/lactating women in these homes.

Some of our earlier suggestions can contribute to wider distribution, e.g., those in section X which urge the cutting down of overheads in order to raise procurement price per litre (thus enabling small producers to enjoy increased income plus the option of retaining some milk for domestic consumption), and to decrease retail prices in order to encourage access to milk. Similarly, our stress on the manufacture of ghee in distant rural areas will ensure that nutritious buttermilk is retained there, while the sale of ghee provided income which is not diminished by the high overheads of marketing fluid milk from these areas. Where ghee is industrially produced buttermilk should be generated as a byproduct and channelled to poor households. No further emphasis need be given to the manufacture of luxury foods such as chocolates and cheese from scarce milk.

We further suggest that dairy policy return from the Operation Flood approach, which is insensitive to income differentials, to the strategy of earlier urban milk schemes that supplied milk of varied fat content (and thus of varied price) to cater to various income groups. On the same lines, some element of redistribution can be built into rural procurement networks, as with the proposition that dairy co-operatives provided subsidised milk

to the poorest children in the village where the co-operative is located.<sup>63</sup> We would also suggest some effort at consciousness-raising among affluent groups. Rather than encourage these groups to drink more milk (and Operation Flood sends out commercials to this effect over television), they should perhaps be educated on how much milk they need and the priority requirement elsewhere for the milk they consume over these levels. Indeed, the use of milk substitutes could possibly be encouraged among the elite, since these substitutes are popular with their reference groups in the west and also counter the diseases of affluence such as cholesterol accumulation. At the other end of the socio-economic spectrum, special feeding programmes should be designed and implemented, if necessary with the help of voluntary agencies, to provide milk to those who require it most physiologically but have the least access to it.

## XII Conclusion

In this section, we would like to make some final points. The first of these is that the alternative dairy policy outlined in this paper does not represent a break from the trend of such policy in the longer term perspective of twentieth century India, but only a break away from Operation Flood and the recent five-year plans which the programme has influenced. Earlier five-year plans,<sup>64</sup> official documents put forward in the years soon after independence,<sup>65</sup> the profile of India drawn by nationalist leaders in the final decade of imperial rule,<sup>66</sup> reports and recommendations by British officials long resident in and deeply familiar with India,<sup>67</sup> all contain strategies and suggestions which we have woven into this paper. None of these early policy documents advocated the total take-over of India's dairy sector by production and marketing technology borrowed from Europe in the manner of Operation Flood. Indeed, some argued against such wholesale westernisation.<sup>68</sup> Neither did these earlier documents glorify traditional Indian systems of dairying nor

suggest that they remain hallowed and unchanged. All advised intelligent intervention in order to enhance the efficacy of these systems, with the selective incorporation of innovations from other countries, as we do in this paper.

Further, as an exercise in policy analysis and advocacy, we have here critically examined the Operation Flood programme as it is *designed*. The programme as implemented seems to show some significant divergence from its policy design, because of the difficulty in implementing a policy which (as we argue) is singularly unsuited to Indian reality, thus necessitating situational adjustments.<sup>69</sup> We suggest that the implementation of the programme (and those situational adjustments) in various areas be closely studied in order to throw light on local needs, as well as on the constraints faced by dairy development, so that suitable decentralised strategies may be devised.

We also wish in closing to reiterate our admiration for the professionalism, commitment and zeal which has gone into the Operation Flood programme, although we disagree with the programme's design. Indeed, no alternative dairy policy will be successful unless these same qualities provide the required fuel. Our alternative is in fact a child of the Operation Flood policy, if a dissenting child and a throwback to earlier forms of dairy policy. Had not the programme been so integrated, aggressive and high profile, we would not have been stimulated into assessing it and formulating an alternative.

In conclusion, we move to a broader problem with which all policy in India must often grapple, and not only dairy policy, although it has been explicitly raised in the context of dairy development generally and of Operation Flood in particular by Doornbos et al. This is the choice between what is techno-economically necessary and what is socio-economically desirable, the much debated question of whether policy should be designed to favour efficiency or redistribution. However, in the previous sections when outlining what we felt were suitable measures, it appeared that by and large what

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was techno-economically feasible (viz, low-cost, labour-intensive decentralised development) was also socio-economically desirable, in that such dairy development would not bypass small producers and low-income consumers. To that extent, the head need not be posed against the heart while designing an appropriate dairy policy for India, and such a policy could be tough-minded at the same time that it is tender-hearted.

### Notes

[This is a slightly revised revision of a paper presented at a seminar on India's Livestock Economy, organised by the Indian Society of Agricultural Economics at the Centre for Development Studies, Trivandrum, March 26-28, 1987.

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1 As reported in the *Indian Express*, March 12, 1987.

2 See for example various documents, of the National Dairy Development Board, Anand, and especially NDDB 1977. For a critical description, see George 1985, where many of the arguments put forward in this paper are discussed and documented more extensively.

3 Batra 1986.

4 FAO 1981.

5 World Bank 1978.

6 Singh and Kelly (1981) provide the figures for Amul Dairy.

7 Khurody 1974.

8 NDDB 1977.

9 Dogra 1981.

10 Jha Committee 1984.

11 *Indian Express*, op cit.

12 NDDB, op cit.

13 As reported in the *Economic Times*, January 28, 1987.

14 See Commission of the European Communities 1987.

15 Dogra 1981 and 1982.

16 Nair 1985.

17 Crotty 1980.

18 Batra 1981.

19 Huria and Achaya 1980, Gopujkar et al 1985.

20 Baviskar 1983.

21 Thapar 1987.

22 Rajapurohit 1979.

23 Nair and Dhas 1986.

24 See NDDB 1978 for the various papers presented at the National Conference on Crossbreeding.

25 The suggestion is by K N Nair.

26 Singh 1979.

27 Nyholm et al 1975.

28 NDDB op cit.

29 Huria and Achaya op cit.

30 Kulkarni 1953.

31 Gupta 1978.

32 Personal communication from K N Nair.

33 E.g. Cattle Conference 1937.

34 Rawat 1978.

35 Government of Maharashtra 1974.

36 Rajapurohit op cit.

37 Jha Committee op cit.

38 Shukla and Desai 1978.

39 Singh and Singh 1986, India Committee of the Netherlands 1985.

40 Doornbos et al, op cit.

41 *Ibid.*

42 Nair 1981.

43 Personal communication from K N Nair.

44 Jul 1978.

45 Government of Maharashtra, op cit.

46 FAO 1965.

47 For a description of the KDCMPU, see Singh and Kelley, op cit, and Ulrey 1966.

48 Joslen (1905) shows that this efficiency long pre-dated the organisation of the KDCMPU.

49 Patel 1983.

50 For information on the Aarey Colony, see government of Maharashtra, op cit. For a brief description of the Choryasi co-operative, see Baviskar 1986.

51 St Xavier's Non-formal Education Society 1984.

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- 52 Government of India 1947.
- 53 FAO 1965; Apte 1982.
- 54 FAO 1981.
- 55 Apte, op cit.
- 56 For a discussion of protein malnutrition among children in the Kheda district itself, see Mehta 1981.
- 57 NDDB 1982; Shah 1981.
- 58 Huria and Achaya, op cit.
- 59 Ibid; Gopujkar et al, op cit.
- 60 Batra, op cit.
- 61 See Heredero 1983 for an account of how the procurement price received by poor tribal producers is eroded by milk grid technology.
- 62 S S Johl, quoted in the *Indian Express*, September 28, 1986.
- 63 Punalekar 1982.
- 64 Government of India 1952, 1956 and 1961.
- 65 E g, Royal Commission 1928.
- 66 E g, Government of India 1947.
- 67 Sub-Committee 1948.
- 68 Wright 1937.
- 69 Baviskar op cit describes 'distortions' in one replication of the Anand pattern which are 'actually adaptations to local conditions'

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