# THE ROLE AND RELEVANCE OF FEED PROCESSING IN DEVELOPING COUNTRIES

by

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## INTRODUCTION

Feed mills together with the computerized formulation of rations are considered to embody the expression of advanced, modern, and scientific forms of animal nutrition. The role and relevance of modern feed mills in developing countries have been questioned (Jackson, 1981).

Feed formulation based on conventional feeding standards assumes that feed intake is not affected by composition and that there is straight additivity among feeds.

However, these basic premises do not hold for most feeds available in the tropics in which most developing countries are situated.

With feeds below 55% digestibility, the first limitation to overcome, with regard to the ruminant (the most common of domesticated animals) is low food intake (for example see Blaxter et al., 1961). In many developing countries, grain concentrates are the only resources with digestibilities above 70%. However, this constitutes less than 10% of the total feed resources available locally. On the other hand, the most abundant feeds such as grasses, weeds, straws and sugarcane tops are fibrous with digestibilities in the range of 45-55%. It is important to recognize that indiscriminate supplementation of fibrous feeds with large amounts of starch and sugars may depress digestibility and thereby depress overall feed intake and utilization (Preston and Ørskov, 1985).

Obviously, large increases in animal production can be envisaged, if efficient utilization of locally available fibrous feeds can be achieved. This is a strategy with enormous potential for reducing the dependence on imported concentrate feeds. Nevertheless, in the developing countries in recent years large investments have been made in feed mills and less attention has been given to stimulating the efficient utilization of local feed resources.

## Identification of projects - technological decision-making

### The project cycle

To understand how decisions on the construction of feed mills in developing countries are made a study of Figure 1 is useful.

General indications of objectives, methodologies and technologies are usually developed in a macro plan (such as five-year plans, sector or regional plans). Choices are becoming more clearly defined in what, in the present context, will be termed the project cycle. This comprises activities like identification, preparation, appraisal, implementation, monitoring and evaluation - both on-going and ex-post.

Irrespective of the source of finance, or country, there is always a sharp reduction in the number of people involved in project cycle activities compared to those involved in the formulation of macro plans. The macro plans are developed by generalists such as economists and politicians, whereas it is the 'technical experts' who dominate the project cycle.

### Society - technology interaction

To gain insight into how decisions are legitimized within the project cycle with regard to any technological innovation, it is useful to look at a model for society-technology interaction proposed by Reddy (1981).

According to the latter every society generates wants which are passed through a filter of 'decision-makers' so that it is not all wants, which are transmitted as demands to those responsible for generating the technology (e.g. educational, scientific and technological institutions). The population of developing countries is divided into a number of groups. These include a small, relatively well-to-do elite (usually educated in industrialized countries or with their concepts) and a large group living more typical rural lives. This paints a picture of stratified, developing society in strong interaction with the industrialized World (see Figure 2).

The sizes of the circles 1-1, 1-2, and 1-3 have been drawn to illustrate the relative sizes of the populations. The rows representing the educational, scientific, and technological institutions (3-1

and 3-2) and technologies as applied in the societies (4-1, 4-2 and 4-3) have also had the sizes of their circles drawn very approximately to the relative magnitudes of the research and development expenditures. The arrows show the connections. There is a very weak linkage between the rural people and the research and development institutions, although there are areas of common interest such as the eradication of certain contagious diseases, which may threaten everybody, irrespective of social status.

There is a strong overlap of the wants of the elite of the poor countries with those of the people of the industrialized countries. The wants of the rural poor are almost completely isolated (2-1, 2-2, and 2-3). The result is that few are aware of or skilled in the demands of the rural poor and, no adequate solutions can be presented in the project cycle (Figure 1), which are useful to the large majority of rural poor. To closely define the points, the following statement by Chambers (1984) put the main points quite succinctly (sic).

"Over a wide range, there remains deep ignorance about many researchable physical and social aspects of rural life - soil erosion, the diarrhoeas, the political economy of pastoralism, drudgery-reducing technology for rural women, the management of canal irrigation systems, levels of human calories requirements, seasonal interactions between nutrition, work, sickness and indebtness, the relative importance of different contingencies which make poor people poorer, forms of organizations to overcome the tragedy of the commons - to make but a quick, short list which could be extended many times over".

Chambers (1984) puts this into perspective by adding:

> "A tiny diversion of resources to increase sensitive research on topics such as these might mitigate the misery of many millions of people. But the mainstream of the R and D system flows in another direction, passing by on the other side, and drawing resources away after it".

This places the two main theses of this paper into perspective.

From Figure 2, a strong connection between the educational, scientific, and technological institutions of both the developed and the developing countries (3-1, 3-2) is seen. Encouraging this connection are financial scholarships offered to students from

developing countries to undertake higher studies or touring programmes in industrialized countries.

All the participants in the project cycle (Figure 1), almost without exception and almost irrespective of nationality, have passed through at least one and often more of the Institutions in industrialized countries and are influenced by their professional values. This has often resulted in a lack of appreciation and understanding of development issues and in the words of Tarte (1984), "This is only likely to come about if the future architects of agricultural development strategies are found in the environment where these same strategies are to be applied".

How are the deficits to be calculated?

Feed requirements calculated for all animals in many developing countries using conventional feeding standards have been used as one of the justifications for putting up feed mills.

For such estimates to be correct, they must be based on correct information about the size of the animals and their ability to cope with local feeds. It makes a lot of difference, whether an average weight of 100 or 200 kg animal liveweight is assumed. The point is illustrated in Figures 3 and 4. Figure 3 relates to the weight of cows in Bangladesh. It was found that 74% of the cows in the particular locality of the survey weighed $\leq$ 150 kg. The smallest was 97 kg.

Figure 4 shows a clear positive relationship between farm size and size of working animal.

Other factors that are often overlooked are seasonal variation in feed supply. Feed supply from common land and weeds has generally not been included.

Obviously, the fact that millions of animals survive and produce on feeds that conventional feeding standards do not adequately interpret makes calculations on national feed requirements based on such standards extremely questionable.

Allocation of feed resources among animals on small farms

Amble et al (1965) published data collected from more than 12 000 Indian households on the diets of animals (see Table 1). Twenty

years later, this still appears to be the feeding pattern followed by the large majoricy of Indian farmers. The lactating and working animals are the ones given the most nutritious feed, they are the animals of greatest and immediate source of income to the farmer. All animals received dry fodder, but the milking and working animals receive more green fodder and concentrate than the dry and young stock.

Milk replacers

Millions of farmers in developing countries allow the calf to suckle some proportion of the milk produced. According to standard dogma, milk is expensive and it is therefore advisable to replace it with a less expensive milk substitute. However, most indigenous cattle will not let down milk without the stimulus of the suckling calf. With Zebu cattle and their crosses suckling increases milk yield, reduces the incidence of mastitis and prolongs lactation (Preston 1983). In addition, milk suckled from its mother (oesophageal groove reflex), effectively avoids rumen fermentation and is passed to the abomasum of the calf directly. This ensures a supply of nutrients (Ørskov 1982), important for its growth and disease resistance.

The ingredients composing a calf starter are scarce commodities in developing countries and most of them can equally well be used to supplement diets of milking animals. This in turn would result in more milk of a higher quality, which will also influence the growth of the calf (Table 2) (see also Gonzalez et al 1982; and Topps 1983).

Are feed mills a priority?

The answer to this question is negative. It will be more important to intensify general agricultural production as this will automatically leave much more feed for the animals, either as a result of more crop residues or fodder crops in the farming system. As the cereal/medicago experience demonstrates (Figure 5), adaptation of the correct farming system holds immense potential for increased livestock and cereal production. Restoration of common land can also be combined with production of more food for livestock - or production of nutrients that are limiting the utilization of the feed produced on the farm. More local labour will be employed in providing inputs for animal production.

Priorities are wrong, when development programmes invest 5-10 times more in feed mills than in utilization and development of local feed resources including suitable farming systems.

The basic issue is addressed in Dr. Reddy's (1981) proposal to make the "wants" of the majority of rural people penetrate as "demands" upon the educational, technological and research institutions (Figure 2). Technology has always had a role to play in any society. But to be able to develop appropriate animal nutrition technologies an environment has to be created, within the relevant institutions, which rewards work on indigenous problems and which stresses close contact with the potential users of a new technology.

Examples exist in developing countries which illustrate how fruitful such an approach can be. It is a real option for decision-makers within educational, scientific and technological institutions as well as decision-makers within national and international development organizations to strengthen this approach by directing more resources towards research and rapid communication between scientists and farmers within and between developing countries.

## The role of feed mills

Feed mills have been at the spearhead of temperate technology transfer with all the associated problems arising from the lack of appreciation of the needs of small farms. The concept of balanced cattle feed took no recognition of the major constraints to productivity of cattle in the hands of small farmers in developing countries, which is the imbalance in nutrients in the basal diet. In developing countries the basal diet is almost always a crop residue or a dry mature pasture, as compared with maize silage, high protein hay or grass/legume pastures in the industrialized countries. What is needed, and is being taken up by the National Dairy Board of India (Kunju, this symposium) is the manufacture of supplements formulated so as to provide the complementary nutrients that ensure an efficient fermentative digestion in the rumen and an efficient metabolism of absorbed nutrients in the cow. In other words feed mills that target their products at the rural producer should concentrate their attention on the manufacture of appropriate supplements based on agroindustrial byproducts that are locally available. A good example of the appropriate technology is the manufacture of urea/molasses blocks which promote efficient rumen function; and protein concentrates with a high capacity to bypass the rumen (see Kunju; Leng, this symposium).

Relevant expertise

There is an immediate need to improve the quality of the expertise represented in the project cycle (Figure 1). Today the situation is that too many people with inadequate understanding of development issues are dominating the cycle; largely because their formal qualifications are acceptable to top decision-makers within local governments, national and international aid organizations, but also - because they possess the necessary resources to catch the attention of the decision-makers.

More should be done to include people with relevant experience in project identification, appraisal, implementation, monitoring, evaluation and to ensure continuity and accountability to the people the projects are supposed to benefit. One way of doing this would be to establish annual meetings where basic premises, recent research findings and strategies are discussed. The proceedings of such meetings must be published and distributed to relevant people and institutions in developing countries.

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Table 1: Feeding of cattle and buffaloes in India

| Class of animal | Type of animal | Amount of feed fed/animal/day in kg fodder | | |
|---|---|---|---|---|
| | | Dry[2] | Green[2] | Concentrates[1] |
| In milk | Cow | 3.5 | 4.4 | 0.3 |
| | Buffalo | 5.9 | 6.8 | 0.8 |
| Dry | Cow | 2.8 | 2.8 | 0.1 |
| | Buffalo | 4.0 | 4.3 | 0.1 |
| Adult | Cattle | 3.7 | 5.0 | 0.3 |
| Males | Buffalo | 5.4 | 6.5 | 0.2 |
| Young | Cattle | 1.5 | 1.6 | negligible |
| Stock | Buffalo | 1.7 | 1.6 | negligible |

Source: Amble et al. (1965, p. 231)

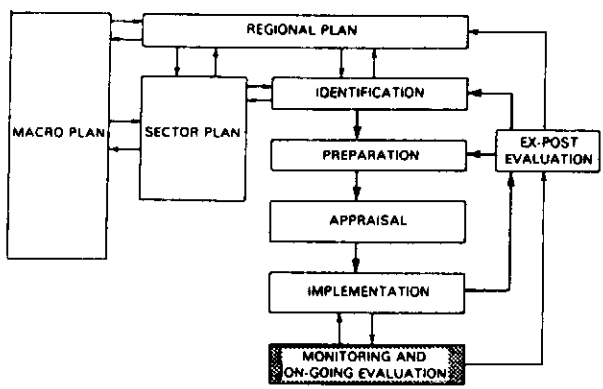
Table 2: Effect of dam's diet on calf's performance

| | Treatment (Dam's diet) | | | | | |
|---|---|---|---|---|---|---|
| | Treated Straw | Treated Straw + Gliricidia | Treated Straw + Leucaena | Treated Straw + Coconut Cake | Treated Straw + Gliricidia + Coconut Cake | Treated Straw + Leucaena + Coconut Cake |
| Liveweight gain calves (g/day) | $254 \pm 50^{c}$ | $329 \pm 51^{ab}$ | $322 \pm 43^{b}$ | $270 \pm 66^{a}$ | $372 \pm 66^{a}$ | $287 \pm 71^{cb}$ |
| Relative gain calves | 100 | 130 | 127 | 107 | 147 | 113 |
| Milk intake calves (g/day) | $0.86 \pm 0.29^{de}$ | $1.01 \pm 0.23^{bd}$ | $0.80 \pm 0.09^{ce}$ | $0.94 \pm 0.19^{cd}$ | $1.10 \pm 0.44^{abc}$ | $1.02 \pm 0.26^{ab}$ |
| Relative milk intake | 100 | 118 | 93 | 110 | 128 | 119 |
| Milkfat intake calves (g/day) | $77 \pm 19^{bcd}$ | $94 \pm 22^{ab}$ | $70 \pm 20^{d}$ | $96 \pm 42^{abc}$ | $110 \pm 10^{a}$ | $99 \pm 26^{a}$ |
| Relative milkfat intake | 100 | 121 | 90 | 124 | 143 | 128 |

Source: Perdok et al. (1983). Significant differences ($P < 0.05$) between means are indicated by dissimilar superscripts (a, b, c, d, e).

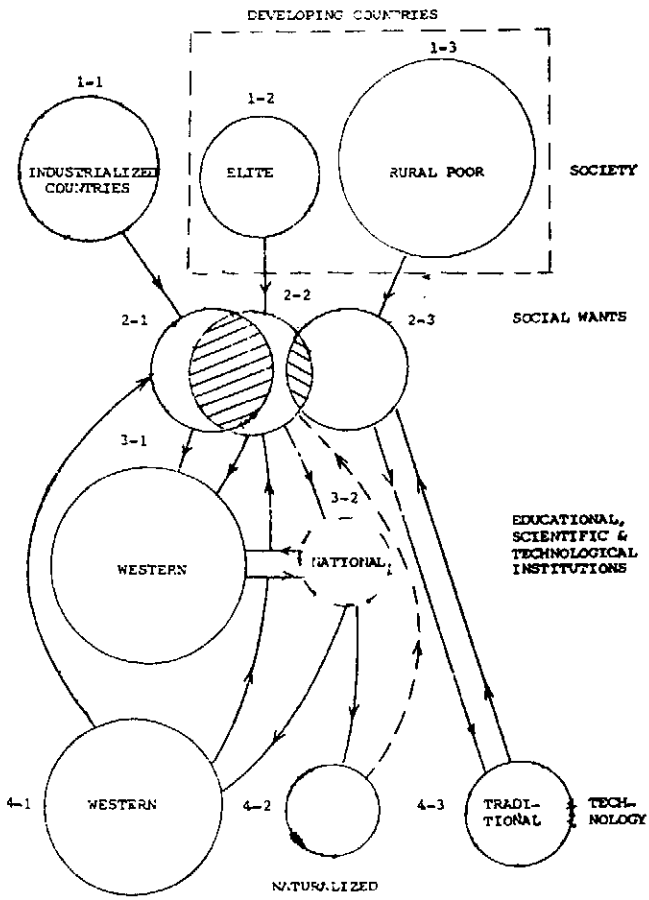
Note: Treated straw = urea (ammonia) treated paddy straw.
Gliricidia = leaves of Gliricidia trees
Leucaena = leaves of Leucaena trees

Figure 1: Schematic representation of project planning and operation activities



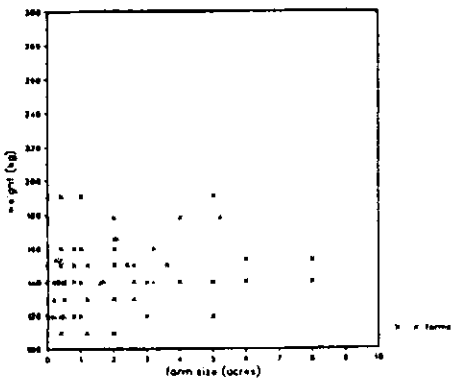

Source: Clayton (1983).

Figure 2: Technology-Society Model for Stratified Developing Societies in Strong Interaction with Industrialized Countries.



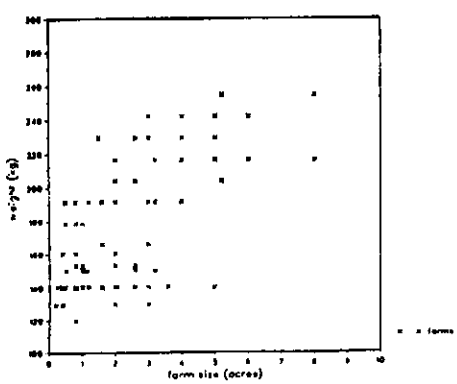

Source: Reddy (1981).

Fig. 3 farm size and animal weight 1st. cow



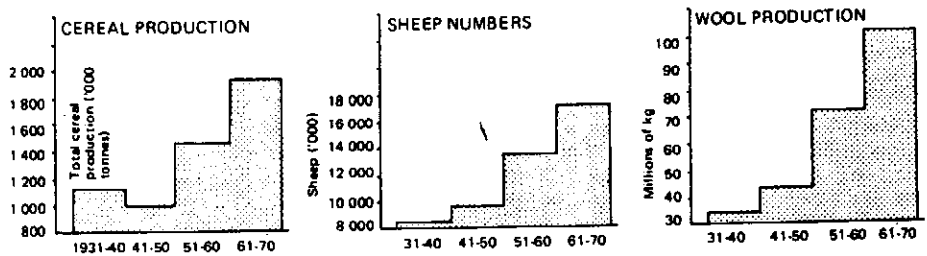

Source: BIDS-CDR Joint Noakhali Development Study (n.d.).

Fig. 4 farm size and animal weight 1st. bullock




Source: BIDS-CDR Joint Noakhali Development Study (n.d.)

Figure 5 : Cereal production, sheep numbers, and wool production in South Australia in the four decades since 1930




Source: Chatterton & Chatterton (1979).