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THE PESTICIDES INDUSTRY AS A COMPONENT
OF THE AGRICULTURAL SECTOR

IMPORTANCE OF MEASURES TO PROMOTE PESTICIDE
CONSUMPTION IN DEVELOPING COUNTRIES

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INTRODUCTION

When one comes to think about it, planning the development of a country or planning the development of an industry is a bit like planning and setting up a business of one's own and the trying to ensure that it grows. The process essentially begins with the prospective businessman seeing a possibility of making a profit by means of offering a product or service of value to others. However, he will probably have many problems to overcome before he will be able to set up his business and run it profitably. His very first task, therefore, will be to try to find out what problems he is likely to have, and then to plan how he will overcome them. If he proves incapable of dealing with all of the problems encountered, including unforeseen ones which may crop up, there are considerable chances that his business will prove to be a failure. It is thus very important that he looks very carefully at his sources of supply, his methods and costs of production, storage, distribution and sales promotion to ensure that his business will operate efficiently. If the market is competitive he must pay special attention to evaluating the nature of his potential clients' demand.

For the development of a pesticides industry in a developing country one must follow the same kind of logic. There are a large number of conditions which must be fulfilled before the industry can grow, and play its role efficiently in the process of economic development.

The pesticide market may be divided into the following main classes of consumer:

- household or institutional users of flysprays, etc.
- public pest control services, such as locust control, mosquito control, rat control
- industrial users such as railways (herbicides), storage and shipping agents (insecticides and fungicides)
- agriculture (crop and livestock production).

Agriculture is the most important market for pesticides, and it is worth taking a little time to think about the relationship of the pesticides industry to agriculture and what its role should be from the point of view of overall economic development (which is what this workshop is essentially here to discuss).

The main theme presented in this paper is that pesticides should not be considered merely as a product which a developing country may think about producing locally, with the simple aim of expanding the number of manufacturing plants situated within its frontiers and thus hoping to contribute to its "industrialization"; but that the pesticide industry should be regarded in the broader sense of its ability to contribute to the country's overall national product through increasing crop and livestock production, and by improving productivity on the land.

The pesticides industry may be considered as a crop-production tool similar to a hand-hoe used by a peasant farmer for clearing the weeds out of his field. Just as someone who does not know how to wield a hand-hoe will not be very efficient at clearing the weeds out of a field on a hot day, so a pesticides industry which is not yet well organized will not be capable of making an effective contribution to agricultural productivity or to increasing the country's gross national product.

When one considers that half to two-thirds of a country's working population may be in agriculture, it is apparent that small increases in the productivity of this group (which may produce 25 - 50 % of the gross national product) can be of such greater significance to the nation than the limited number of extra job opportunities which could be created by setting up local pesticide plants. Also it is worth considering whether a country would attain a greater increase of its gross national product and create more new employment opportunities by placing greater emphasis

on the problems of effective pesticide distribution and application, rather than by giving preference to developing local capabilities in industrial chemistry.

For each country the answer must be determined in the light of local circumstances, and the thoughts which are set out below are put forward as a possible framework for working out a policy for enabling a country's pesticide industry to make the best possible contribution to overall economic growth.

Just like the person planning to set up his business and trying to foresee the pitfalls he is likely to encounter, we shall look at the different operations needed to obtain a pesticide and to apply it successfully, and then consider the various difficulties which will need to be overcome.

INTERRELATIONSHIP OF THE PESTICIDES INDUSTRY WITH THE REST OF THE ECONOMY

The increasing interdependence of different sectors as an economy develops is well illustrated by the pesticides industry.

It is dependent for its income on the money which farmers earn from the sale of their crops. Pesticides enable farmers to harvest larger surpluses for sale, or to save the amount of labour that is needed at critical periods of peak labour requirement, e.g. for weeding, and free it for more productive alternative activities such as planting other crops.

In its turn the pesticide industry can provide employment for suitably trained workers.

But demand for agricultural pesticides also depends on the general development of the agricultural sector.

Low yields or risk of drought may limit the benefits to be gained from using pesticides. Where yields are low protection against a loss of, say, 10 per cent of the harvest may not be sufficient to pay for the cost of the pesticide, and should drought cause a harvest to fail there would then be the added loss of the money spent on the pesticides.

The growth of demand for pesticides is very closely linked to the introduction of new farming techniques: irrigation for arid regions, fertilizers, new high-yielding varieties, etc.

The marketing of farm produce can have a considerable influence on the demand for pesticides.

Where marketing channels are efficient their operating margins can be reduced and higher prices can be paid to farmers. It has generally been found that as produce prices rise farmers become more ready to use pesticides. When the Nigerian government decided to raise the price received by growers for cotton by 40 % some years back, this incited them to apply insecticides to their crops, and production more than doubled within a few years, thus enabling the country to increase its exports.

In many cases farmers will have no incentive to treat their produce if they do not receive a bonus for quality. In Kenya the demand for storage insecticides increased considerably after the Maize Marketing Board had introduced a bonus for treated products coupled with a simple method for ensuring that each bag of maize delivered was in fact treated. The reduction in losses during storage more than compensated for the cost of the bonus.

Schemes to stabilise the prices of farm produce are also of importance. Prices of agricultural products are notoriously unstable, and faced with the uncertainty of low prices at harvest time farmers remain reluctant to invest in fertilizers and pesticides during the growing season. In many developed countries stabilisation of prices has been shown to have contributed significantly to farmers' investment in productive inputs and to have contributed towards increasing productivity in the agricultural sector.

If farmers are to be motivated to increase their farm output, they must be offered something to do with the extra money they obtain from their larger harvests. The development of local village shops offering consumer goods plays a key role in providing farmers with an incentive to expand their marketable

output, and also broadens the national market for locally produced consumer goods.

As these factors are beyond the control of the pesticide industry, direct or indirect government measures are here in many cases of great importance for ensuring the growth of the pesticides market.

ANALYSIS OF THE FUNCTIONS OF THE PESTICIDES INDUSTRY

Ideas may vary regarding the precise functions which should be undertaken by the pesticide industry in a developing country, and the limits of its responsibilities. But it may be useful to consider the various stages needed to obtain a chemical and apply it to the crop or animal which needs to be protected.

Each stage is described below paying attention to factors which may cause it to limit or enhance the usefulness of the pesticides industry to the economy.

1. Selection of the pesticides most suitable for the country

Agricultural conditions vary greatly from one country to another, even for a single crop, and the methods of distribution, storage and application may differ substantially, as well as the technical ability of farmers. Selection of the most suitable pesticides must be done within the country on the basis of knowledge of local conditions. However, persons with experience of results obtained in other countries where conditions are similar may often have valuable insight into the potential advantages of particular products.

The importer is usually responsible for discussing a pesticide's merits with the government authorities and, if necessary, for carrying out local field trials in order to have it officially recommended or registered.

The importance of selecting the most appropriate insecticide for local circumstances is borne out in developed countries where farmer groups undertake trials to select the most useful product for their particular conditions, which has enabled them to cut

their crop protection costs or improve the degree of protection.

2. Import regulations

Importers often have to comply with administrative procedures before an import permit is granted to them. In some countries a major problem with the granting of import permits for pesticides has been the time which the government departments concerned have taken to allocate them.

It may be that the normal procedures of allocation are slow, or once the amount of foreign exchange has been allocated, the procedures for verifying the use to which the funds are put may delay shipment by several weeks. In many cases pesticides are worthless unless they are rapidly available immediately an unforeseen outbreak of a pest or disease occurs. In one case the formalities took so much time that the importer was forced to reduce the quantity of pesticide purchased so as to use a considerable part of his foreign exchange allocation for airfreighting the product in order to ensure that at least part of the crop could be saved in time.

National regulations often insist that importing be undertaken only by locally registered companies. Where competition between local importers is not strong enough, or where they do not have sufficient know-how, they may be less efficient in selecting the most appropriate pesticides and in promoting their sale.

3. Labelling

Labelling must be adapted to local conditions, especially where instructions have to be translated into local languages. This requires personnel who know the local conditions in which each pesticide will be used.

4. Packing

Importing the packing materials and the bulk formulated products separately may be more costly than importing the pesticides already packed according to local specifications. Locally manufactured packing materials may be more costly.

If not well organised the local packing operation may increase the risks of delay when large quantities of a particular pesticide are urgently required by farmers.

On the other hand packing is a fairly simple operation which could give opportunities to local businessmen and it can use unskilled and semi-skilled labour which is likely to be readily available.

5. Formulation, and

6. Manufacture of technical ingredients

Formulation and manufacture are discussed in detail elsewhere in this symposium. However, where local production costs are higher than the cost of importing the packed and formulated product, careful consideration should be given as to whether there is a justifiable saving in foreign exchange. Sudden shifts in demand from one product to another (depending on the severity of different pest outbreaks) and seasonal variations in demand may necessitate irregular production runs resulting in higher costs. Excessive duties on imported raw materials or equipment will raise local production costs. Difficulties in obtaining supplies of these may result in the locally formulated pesticides not being available when really needed, so that the country's agricultural output will then benefit much less from a given expenditure on foreign exchange.

If sufficient highly qualified and experienced scientific and technical experts are not available locally, costly expatriates may have to be employed.

Where satisfactory quality control can not be assured, the usefulness of the pesticide may be severely impaired, leading to a corresponding loss of agricultural output.

7. Pesticide distribution channels

Owing to the fact that farming is spread out over the whole area of a country, distribution of the pesticides from the importing or formulating

company to the farmer is a major operation. Especially where farms are small, distribution must be carried out by local merchants or cooperative societies.

Inefficiencies in the distribution system (such as loss and wastage, delays in delivery, ordering the wrong products or the incorrect type of pack) put up the cost of the product to the farmer and reduce the gain in agricultural output which can be obtained from the country's expenditure of foreign exchange. Where the farmer has to fetch his pesticide from distant retail depots, the time this takes him may severely reduce the benefit he may gain from using the pesticide.

Often the annual volume of pesticide sales is not sufficient to cover the costs of operating a local retail outlet within easy reach of the farmer, and pesticide sales must be combined with another activity.

Demand for prophylactic treatments tend to be more regular from one year to another, so that pesticide companies and dealers can arrange to have supplies available in advance. But stocks must be built up so that strong seasonal demand can be supplied within a short period. Where unforeseen pest or disease outbreaks occur, stocks should be available to enable pest control measures to be implemented with the least delay.

The pesticide companies or dealers must have sufficient profit margins to finance the credit cover needed for maintaining their stocks. Should these stocks prove to be insufficient to cope with a major outbreak, they must be in a position to obtain extra supplies rapidly from other regions or from outside the country.

The suitability of local merchants as pesticides sales outlets will vary from one country to another. Where farmers willingly repay their debts in cash, credit for their pesticide purchases may be readily extended to them until harvest. In other cases a cooperative which buys their harvest may be the only kind of outlet which could extend credit to farmers at reasonable terms with satisfactory assurances that the reimbursement will be obtained.

In short, measures to improve the capability of persons working in all stages of pesticides distribution, and the promotion of healthy competition, should increase the efficiency of this operation and limit the need for excessive price mark-ups as well as contribute to distributors' ability to supply sudden surges in demand resulting from unforeseen pest or disease outbreaks. Distribution is a key operation which can only be carried out within the country, and which is entirely dependent on the capabilities of the local people.

ADVICE TO FARMERS ON PESTICIDE USE

Expertise is needed in identifying the pest or disease, choosing the appropriate pesticides, applying it correctly and at the correct time. The greatest benefit will be obtained from using a pesticide, only if it is combined with the optimum use of other farm practices.

Farmers need to be advised about all these matters, to be convinced of them (demonstration plots, etc.), and motivated to use pesticides themselves.

This entails a great deal of promotional work amongst farmers, and it must be kept going for a number of years before significant results can be expected. In the United Kingdom one advisory officer estimated that farmers would take an average of five years' propaganda effort to adopt a new technique on a permanent basis. For less educated farmers in developing countries the necessity of maintaining a sustained advisory effort over a number of years is evident.

Opinions differ as to what extent governments should be responsible for carrying out these advisory activities. On the one hand pesticide companies are reluctant to invest money in advisory activities extending over a period of years if the benefits are to be reaped by competing companies who arrive on the market at a later stage. On the other hand many developing countries are still in the process of setting up their advisory services which are often not equipped to provide farmers with detailed information on the advantages to be gained from the use of pesticides.

However there is no doubt that an effective advisory service is an important key to creating and expanding the market for pesticides. It is important to companies that farmers have constant access to advice on the correct use of pesticides. As in the case of consumer products, well oriented sales promotion is absolutely necessary for achieving a significant expansion in the market for a product. But with pesticides the greater degree of technical knowledge which is needed for the correct use of the product, is a major obstacle. Even in developed countries there is much debate as to what extent the government, or pesticide companies (or even farmers) should pay for the pesticide advisory services.

INDIA: FACTORS THAT PROMPTED FARMERS TO START USING PESTICIDES

(% of users mentioning each factor in 1964/65)

State	Agricultural extension workers	Demonstrations	Suggestion of friends	Other factors
Andhra Pradesh	83	63	13	-
Madras	59	63	27	6
Mysore	95	71	54	26
Maharashtra	3	47	71	21
Punjab	100	100	-	-
Uttar Pradesh	78	52	19	13

Source: Pesticides in Indian Agriculture. National Council of Applied Economic Research, New Delhi, 1967.

INDIA: REASONS GIVEN BY FARMERS IN 1964/65 FOR NOT USING PESTICIDES

(% of users mentioning each reason)

State	Not aware of pesticides and their efficacy	Do not have enough financial resources	Not aware of pest attack
Andhra Pradesh	52	64	-
Madras	37	39	3
Mysore	42	62	14
Maharashtra	75	48	14
Punjab	64	7	-
Uttar Pradesh	55	34	30

Source: Pesticides in Indian Agriculture. National Council of Applied Economic Research, New Delhi, 1967.

Any plans for expanding the imports or production of pesticides in a developing country must be accompanied by plans for intensifying the pesticide advisory services so as to ensure market expansion. Conversely an investigation of probable losses caused by pests and diseases would in many cases indicate substantial gains in the country's gross national product, which could be achieved if effective advisory services contribute to improving crop protection practices.

In Nigeria for instance where black pod disease and capsids were devastating cocoa trees, the government was forced to teach the small farmers how to spray their trees, in order to safeguard the foreign exchange which the country earned from cocoa exports. In Kenya on the other hand, peasants' inability to master the techniques for controlling coffee-berry disease is a major reason why many are turning away from coffee to other crops.

Advice to farmers must be adapted to local conditions and take account of all the factors to which they are subjected. Farmers are often accused of being lazy when they do not follow advice on pesticide usage. In some cases they might not yet have really grasped the significance of the benefits which they could obtain. In other cases low yields or risk of drought may limit the benefits to be gained from using pesticides. But there may also be practical problems associated with the pesticide application, such as there being no ready supply of water for preparing the spray. Or there may not be sufficient labour available at harvest time to pick the whole crop if its yield is increased. For advice to be effective, detailed local knowledge is necessary to ensure that farmers can be helped to overcome all the obstacles to benefitting from the use of pesticides.

9. Pesticide application equipment

Providing farmers with application equipment suited to their particular farming conditions, has been a major problem. Dusts and granules have the advantage of requiring less sophisticated application

equipment, but due to their bulk the costs of transporting them over long distances are higher.

In some regions where small farmers do not have a nearby water supply for mixing sprays, low priced ULV sprayers have been developed. However, because of poor maintenance few have lasted more than a season.

10. Pesticide application services

One advantage of a pesticide application service is that small farmers do not have to invest in spraying equipment of their own. Another advantage is that pest control advice given to the spraying contractors becomes applicable to a much larger number of farmers. In some cases the added cost of paying separate people to carry out the application, is offset by savings in the number of farmers who would otherwise have to be taught and supervised.

In India where commercial pesticide application services have increased their activity in recent years they have brought about a very significant increase in the expansion of pesticide use.

It is most probable that more than one firm will be involved in these successive operations. Some may be carried out by the government. But because all these stages are necessary to complete the chain of operations for getting pesticides to where they are needed, each stage may be considered as forming an essential part of the "pesticides industry".

CONCLUSIONS

The growth of the pesticides market depends firstly on the government measures taken to encourage agricultural production (e.g. the development of rural transport and communications systems, availability of consumer goods and other incentives to farmers, price policies, general advice on farming methods, availability of

high yielding varieties, fertilizers, irrigation facilities).

Government also has a regulatory role to play in ensuring the safety and efficacy of pesticides made available to farmers, in preventing fraudulent dilution of products sold by the trade, and in limiting unwanted residues on export crops and on the nation's food, as well as in protecting the environment.

Then, bearing in mind the overall needs and resources of a developing country, the analysis set out in the table on Annex I may be proposed as an aid for identifying the components of a country's "pesticide industry" to which the highest priority should be given for further development.

If attention can be paid to developing these priorities in the right order, it is suggested that the measures will have a greater chance of success, and less strain will be placed on the economy in terms of protective duties or subsidies needed to maintain unprofitable operations.

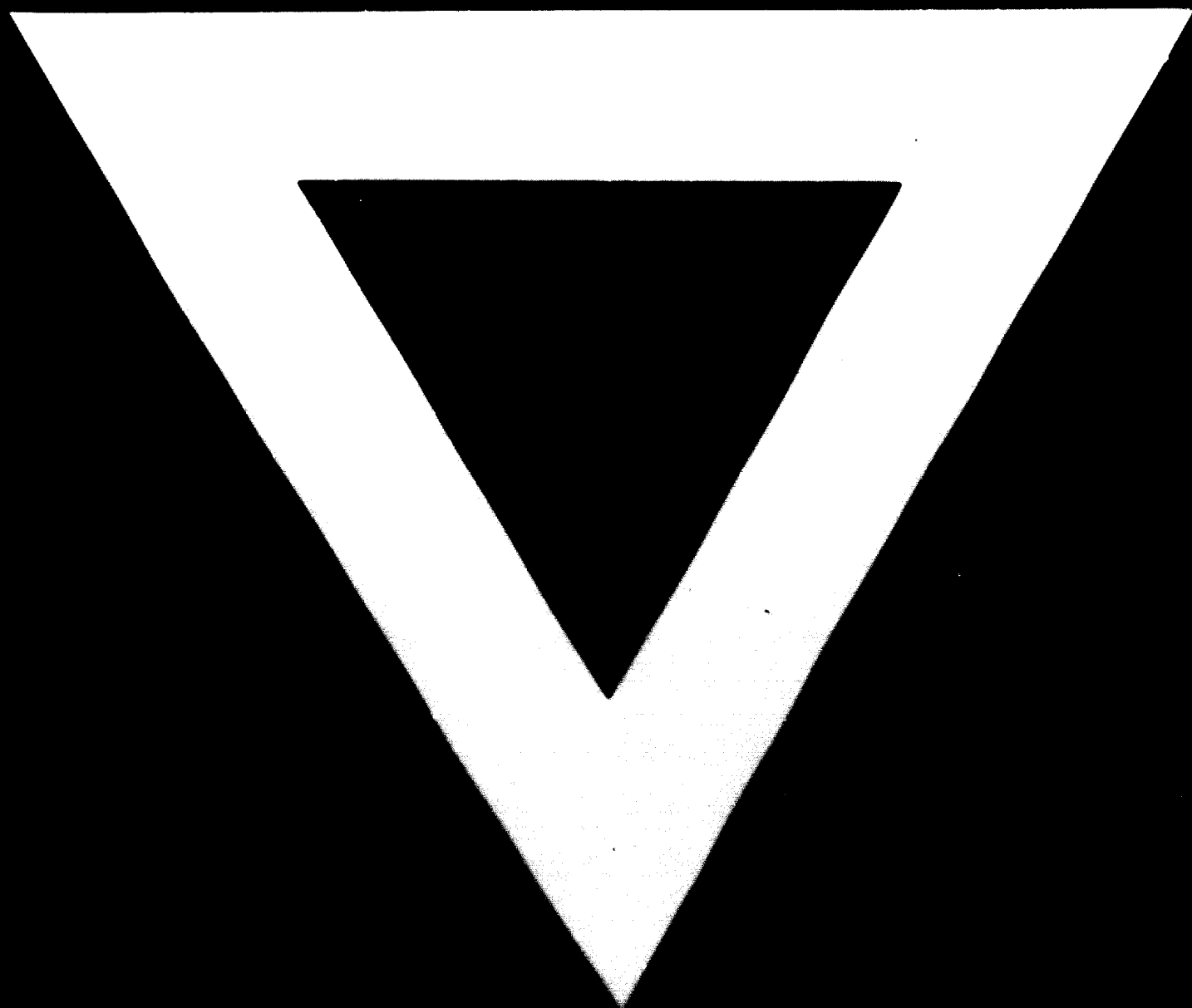
It would appear from this table that the components of the "pesticide industry" which would have the highest priority for development would be those where local activity is essential, namely the components 1, 2, 3, 7, 8, and 10. Weaknesses in these components would slow the growth of pesticide use and hamper the increase in agricultural productivity, while limiting the profitability of formulating and pesticide packing activities. The capabilities which need to be developed for these "high-priority" components of the industry are essentially on the one hand, agricultural experts capable of selecting the appropriate pesticides, advising on their use and applying them on the basis of their knowledge of local conditions; and on the other hand, persons with the administrative and business capabilities needed for running an efficient distribution network in the particular conditions of the country.

Efficiency in the "high-priority" components of the industry is essential for

the pesticides industry to develop. Once the country is assured of its ability to select the most suitable pesticides and to promote their use correctly (creation and expansion of the market), consideration may be given to the development of the remaining components of the industry, taking account of the skills and raw materials already in the country and not forgetting the minimum quality standards required of an effective product. It would then seem that the industry components 4, 5 and 6 could successively be considered for local development.

ANALYSIS OF THE DIFFERING COMPONENTS OF A COUNTRY'S PESTICIDE INDUSTRY

Component	Products, services and/or expertise which may be suitably imported from abroad	Local activity is essential	Products, services and/or expertise which are readily available within the country	Qualifications which need to be developed locally	Disadvantages of local activity
1. Selection of most suitable pesticides	Foreign expertise needed for cross fertilization of ideas	Yes. <i>Local field trials Approval (safety, efficacy, residues)</i>	Depends on availability of local graduates	Pesticide experts with detailed local knowledge are essential. Need for trial plots in country's main agricultural regions. Pesticide experts in the Ministry of Agric.	Local experts must know all the pesticides on the world market.
2. Import regulations	foreign exchange used for buying pesticides should be recuperated by increased agricultural exports, reduced agricultural imports, or cheaper food prices rendering other industries more competitive on export markets. Import regulations should not reduce the value of pesticides by delaying their arrival in the country.	Yes		Efficient processing of import permits.	
3. Local labelling	Labels for foreign countries will give preliminary indications of how a product may be used <i>locally</i> .	Labels must be in local languages and refer to local conditions.	Depends on the availability of local graduates, <i>who are able to prepare instructions for local use.</i>	Printing works.	
4. Packing	Packing materials may have to be imported. Foreign suppliers would normally be able to pack according to local specifications.	A fairly simple operation which could give work to local businessmen. Packs can be specially adapted to local conditions.	Unskilled and semi-skilled labour likely to be readily available.	Manufacture of packing materials (at higher cost than imported materials?)	
5. Formulation	Technical products, solvents, emulsifiers, carrier dusts, etc.	Local expertise is needed to check the suitability of formulations for local conditions.	If raw materials for carrier dusts are available locally, transport costs on the imported products could be reduced. Other products may be available from the local chemical industry. Expatriate experts costly if local expertise unavailable. Capital equipment may have to be imported.	Laboratory facilities for controlling the quality of local formulations. Irregular quality reduces effectiveness of the pesticides. Highly specialised facilities may have to be given to institutions of the country.	Quality may not be maintained. Choice of formulations may be reduced.
6. Manufacture of the technical ingredients	Technical products no longer covered by patents tend to be readily available at low prices <i>on the world market</i>		Will depend on state of development of the country's chemical industry.	All the specialities of a fully developed chemical industry.	Very highly specialised facilities to be developed. Cost of plant & setting it to work efficiently. Plant may be too small to use full capacity. High cost of returning to other pesticides if the market for ingredients is large. Difficulty of maintaining high quality standards.
7. Pesticide distribution channels	Some foreign expertise may be useful.	This activity can only be carried out locally.	Distribution needs less skill than manufacture of fine chemicals. More scope for successfully training people to work in this sector.	Transport & communications networks reaching farmers must be developed. Management, managerial personnel must be trained.	However inefficient local distribution channels may be, there is no alternative to improving them.
8. Advice to farmers on the use of pesticides.	Some foreign expertise may be useful, especially from people with experience of similar conditions in other countries.	Advisers must have intimate knowledge of local farmers' customs & understand how to motivate them. Years of contact needed to gain their trust.	If expertise available will vary from one country to another.	Advisers must be trained with both a theoretical knowledge of pest control and practical experience.	However little local expertise is available, it is essential that a large number of suitably qualified people be trained & then given incentives to do this kind of work.
9. Pesticide application equipment	Application equipment. Some foreign expertise would be useful.		Equipment could be assembled or manufactured locally.	Intermediate skills could be developed fairly readily.	It may be difficult to ensure that the equipment is calibrated sufficiently accurately.
10. Pesticide application services		Only local persons will do the application (whether farmers or specially trained independent operators).	Use of labour in rural areas.	Local people could be trained to have the required level of skill.	It is essential that a large number of people be trained for carrying out this work properly.



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