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GUIDELINES FOR THE DEVELOPMENT OF PESTICIDES INDUSTRY
IN THE DEVELOPING COUNTRIES ^{1/}

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I. BACKGROUND SITUATION

This chapter will only be presented in very brief notes relating the main items of interest.

Because it will be used qualitatively as the basis of ideas of how to promote the development of pesticides industry in the developing countries.

1. Agricultural background

The total land's area of Indonesia is 735,865 square miles.

Total population: 120 million.

About 72 per cent of the total work force is employed by agriculture including forestry and fishing, the main stay of the Indonesian economy which provides 52 per cent of the national income and 80 per cent of the foreign exchange earned by non-petroleum export products, (1971).

Indonesia's main food crops are rice, potatoes, maize, peanuts and soybeans.

Enough food crops are usually grown to supply the rural population, but a problem arose for the urban population. This problem is to be overcome by two simultaneous measures:

- Intensification programme, by using fertilizers, pesticides, better seeds as well as improved irrigation;
- Extensification programme, extension of planted area especially to rich soils outside Java.

For rough assessment the level of intensiveness in agricultural production practices can be simply compared to the Japan situation, an agro-intensive country.

Table 1
Average Crop Yield (1966)
in tons/ha

	<u>Indonesia</u>	<u>Japan</u>
Rice, average	2.26	5.0
Maize, (dry seed)	0.29	2.4
Sweetpotatoes	5.5	19.3
Soybean (dry seed)	0.57	1.23

Table 2
Export Crop Production
(000 M. Ton)

Crop	1965	1966
1. Rubber	715.7	679.7
2. Copra	1,249.2	1,185.3
3. Coffee	111.2	97.4
4. Tea	89.3	37.3
5. Tobacco	80.5	13.0
6. Palm oil	156.7	177.0
7. Palm kernel oil	32.5	31.5

Table 2 shows a rough potential of export crop production. The productivity of export crop production still falls at a lower level compared to more intensive crop production practices.

Meanwhile some experiences in using modern techniques in crop production including the use of pesticides have shown an impressive increase in the crop yield.

These practices have mainly been applied in the estates producing export crops and in the mass intensification programme of the Government.

As this programme has successfully demonstrated the increase of crop yield to the farmers, the use of pesticides is now becoming popular to farmers.

However, purchasing power of the farmer is now becoming the limiting factor.

A local consultant had prepared a rough analysis of consumption ratio by classes: (1966-1968 average)

Insecticides:	85 per cent
Herbicides:	10 per cent
Fungicides:	4 per cent
Rodenticides and others:	1 per cent
	<u>100 per cent</u>

If classified by group of compound, the average composition (1966-1968) will be roughly as follows:

Organochlorine:	75 per cent
Organophosphate:	15 per cent
Others:	10 per cent
	<u>100 per cent</u>

2. Present status of Pesticide Industry

A number of investors have been interested to set up formulating and manufacturing plants during the recent three years. If assessed roughly, they are mostly interested in producing herbicides (manufacture and formulation), mainly for the cash crops.

The second class of main interest is insecticides for rice. The rest are pesticides for household purposes, rodenticides and fungicides. New interest has arisen in nematocides. Field experiments of this class are now being conducted. Only two of the five applicants have been producing pesticide formulations.

The rest are now still carrying out their project preparation.

3. Available resources

(a) Natural

The main natural resources available relating to pesticide industry are:

- petroleum and natural gases;
- derris and pyrethrum flower can be grown in several parts of Java;
- minerals such as diatomaceous earth, talc, bentonite, etc. are also available in several places. They can be used as fillers or dry carriers for solid pesticide formulations;
- Other resources useful for basic chemicals industry.

(b) Capital

Lack of capital is one of the common situations in developing countries. However the Foreign Investment Law has opened to interested investors, preferably in joint-ventures with local partners, the opportunity for setting up industries in Indonesia.

(c) Skill

Shortage of skilled personnel is also common. However, it can be overcome by in-plant personnel training either during the operation of the new factory, or in another country if necessary.

4. Other aspects

Legislative aspects concerning the use of pesticides and alike toxicants has not yet been given proper attention. A bill on Pesticides has been prepared, but it is still being processed in the House of Representatives.

II. PROSPECT OF PESTICIDES INDUSTRY IN INDONESIA

1. General

There are two main bodies governing the prospect of developing a pesticides industry:

- the Department of Industry;
- the Department of Agriculture.

The first Department is concerned with the development of appropriate pesticide industries - based on sound project consideration of course - in supporting the second department's campaign to promote the use of the appropriate chemical pest control.

In case a pesticide industry is not yet feasible to operate, a policy of importing the needed pesticides is regarded as a temporary solution.

If, however, the condition has changed, and a pesticide industry becomes feasible to operate, it will be no reason to put off the investment as long as it will not harm the consumer's and the Government's interests.

The second department is responsible in diagnosing the pest control problem encountered. Then in supporting the resulting pest control programme, the first department assists in promoting the development of pesticide industries to enable the supply of needed pesticides by local production in speedier delivery, in competitive prices instead of using the imported pesticides.

2. The development programme of chemical industry

This topic will obviously come out as the first question before stepping to other related aspects.

Besides, it is understood that pesticides industry can be regarded as a part of chemical industry.

The status of chemical industry in a country becomes the basis and infrastructure for the pesticides industry development. Meanwhile, to get a rough picture of the future chemical industries, the development programme of this sector of industry will play an important role.

The Directorate of Planning and Development of Chemical Industries, a government institution, has subdivided the chemical industry into four Divisions i.e.:

- The Fertilizer and Petrochemical,
- The Cellulose,
- The Silicate,
- The Allied Chemicals and Rubber.

The fourth Division, the Allied Chemical and Rubber, is concerned with other chemical industries which do not belong to the first three Divisions.

It means that the planning of pesticides industry is under the responsibility of this fourth Division.

The development of pesticide manufacturing industry will relate the need of raw materials which are mostly petrochemical intermediates and basic chemicals. It is reasonable therefore to present briefly the prospect of those industries.

The petrochemical industry

Considering the fact that the country has ample resources on petroleum and natural gas, and that it has good prospects in the marketing of their output either as fuel or as petrochemicals, it is understood if the petrochemical industries become one of the important key-industry for Indonesia.

As the term "key-industry" is generally defined as an industry which could cause the largest positive impact on the national economic development, its planning needs intensive, systematic and realistic studies. Moreover the petrochemical projects are mostly capital intensive projects requiring substantial minimum economic size.

It has been known that the following weaknesses are commonly found in developing countries:

- Lack of capital,
- Shortage of skilled personnel,
- Non-developed market,
- Lack of infrastructure.

According to the policy of the Government in conducting the development, high priority has been given to the production of food. Consequently the production of chemical fertilizers falls in the same priority.

At present there is one factory producing urea and another producing urea and ammonium sulphate fertilizers. Extension of the first factory is now being conducted. These two urea plants represent the first petrochemical plants in the country.

The next promising step would probably be plastics and synthetic fibre industries instead of petrochemical intermediates for the manufacture of pesticide chemicals. The possible reasons are, inter alia,:

- Mostly such intermediates are manufactured as by-products of big petrochemical complex in a developed country where the substantial market demand has made this unit feasible to operate.
- Limited and unwarranted market.

Meanwhile to lay down the basis for petrochemical industry development, the Government is still studying the previous reports of the ECAFE/AIDC fact finding team, BEICIP and World Bank's team, while awaiting also the result of the survey to be undertaken by UNIDO, before any major steps could be taken in the implementation of the plan.

The basic chemical industry

The basic chemical industry cannot be disregarded in discussing the prospect of pesticides manufacturing industries. Its function as infrastructure for the development of pesticides industries is obvious if a country is going to rely on self sufficiency.

The term of basic chemicals covers heavy chemicals which are frequently used as inputs for other industries in vast quantities. Belonging to this group are among others: caustic soda, chlorine, soda ash, sulphuric acid/oleum, hydrochloric acid, nitric acid etc.

It is reasonable if the basic chemical industry can be used as an indicator of technological progress of a country. Of the various basic chemicals available there are several such as caustic soda, chlorine and sulphuric acid which could represent their group. Caustic soda and chlorine industry need more careful planning than the sulphuric acid industry.

The main problem in the development of electrolytic plant in developing countries is usually in the marketing or utilization of chlorine. It becomes the limiting factor in the production. This situation will be reversed - like what has happened in the industrially developed countries - if local chlorine consuming industry has been set up. It is expected that the biggest consumer of chlorine, VCM plant, will appear to be feasible by 1980.

Additionally, other smaller chlorine consumers could contribute to some extent in improving the situation i.e. industries using chlorination process in its operation. And as it has been known that a lot of pesticide manufacturing step involves chlorination process.

It can be said therefore that basic chemical industry represented by chlor-alkali industry has come at a stage of preparation to enter a favourable condition for its development. As a general conclusion it can be simply formulated that, as far as the pesticides industry is concerned, the chemical industry development in Indonesia has come to an appropriate time for starting the feasibility study of pesticides manufacturing industry projects.

3. Development programme of the agricultural sector

In this section a rough picture will be presented regarding the development programme of the agricultural sector with special reference to the prospect of chemical pest control in the future.

In the previous chapter the agricultural potential and production and the present practices on crop protection have been discussed. It should become one of the factors to consider for the future development.

As it is realized that the agricultural export contributes a big portion to the national income, its role in the national economic development for the country becomes predominant. It is in line with the Government's policy to emphasize the agro-oriented development in the first Five-Year Development Plan (1969/70 - 1973/74).

The general objectives can be formulated as follows:

- To supply ample food for the people,
- Maximum exploitation of the available agricultural resources,
- Comprising food and industrial crops for domestic consumption as well as for export.

A number of measures which have been undertaken by the Government in accordance with crop protection are, inter alia:

- Mass guidance and intensification, particularly in rice production, in which programme the modern agricultural production practices are applied including the use of chemical fertilizers and pesticides. By this media it is expected that pesticides become more popular to farmers.
- The formation of National Committee on Pesticides, as an institution under the Department of Agriculture of interdepartmental membership. It is responsible in the legislative and control aspects in the application of pesticides. The membership of this Committee is represented by the following departments:
 - Department of Agriculture,
 - Department of Health,
 - Department of Manpower, and
 - A number of research institutes.
- Activation of research institutes under the Department of Agriculture, to emphasize their research activities on crop protection e.g.:
 - Chemical pest control,
 - Biological pest control.
- Plant quarantine measures have also been conducted especially for international and interinsular transfer movement although inter-provincial measures have not been intensively done. Recruitment and training of experts is now becoming a routine programme to overcome the shortage of skilled personnel. There is international co-operation in this field through Technical Assistance programme.
- It is necessary to note here that attention has not been paid to forest pest control programme. Priorities have been given to food crop production and export crops of big contribution to foreign exchange earning, e.g., rubber, coffee, sugar cane, tobacco, etc.
- Co-ordinated programme for promoting the chemical pest control is going to be conducted by the relevant ministries, inter alia, by the promotion of pesticide industry development.

4. Public health sector

Another sector to consider concerning the use of pesticides is the public health sector. This sector cannot be disregarded in discussing its need on DDT for malaria control in Indonesia. Its potential demand for DDT is much higher than the available government fund to purchase. Almost all of the DDT are consumed by several swampy districts outside Java.

The average amount is in the range of 3,000 to 5,000 tons annually, while the potential demand is in the order of 10,000 - 15,000 tons/yr.

5. Potential for pesticides production

Based on the following considerations:

- The promising agricultural potential of the country,
- The farmers have realized the importance of appropriate crop protection measures
- The present status of pesticides industry has come to a correct time to start their development,
- The availability of raw materials for the pesticides industry,
- The policy and programme for the development of chemical industry provides also a special attention to pesticides industry development in supporting the agricultural sector of production,
- The development programme and measures of the Department of Agriculture and the Department of Health have given a good prospect in the near future for chemical pest control.

it can therefore be simply concluded that this country has a promising potential and prospect for pesticides production in the coming years.

III. Planning the development of Pesticides Industry

1. General

The scope of industrial planning actually includes the study of prospect of an industry as discussed in the previous chapter.

However, this chapter will be dealing with further planning steps after having a chance that the prospect for pesticides industry development has been promising.

A more complex problem will be encountered in the projection of demand rather than what is usually encountered in the same work for other common industrial chemicals.

Some reasons that make this work more difficult are inter alia:

(a) We are dealing with hundreds of toxicants/chemicals with various degrees of toxicity.

(b) They should still be subdivided functionally to be used either as insecticides, herbicides, fungicides, rodenticides, nematocides or as other group of toxicant.

(c) Same factors such as type of crop, crop rotation, climatic conditions, etc., governs the selection of suitable pesticides, in a suitable formulation.

(d) Other factors such as:

- specific pest and plant disease situation of a country
- ecological aspect
- environment pollution
- legislative aspect
- how far other pest control methods have been practised in a country (mechanical, physical, biological, etc.)

2. Projection of demand

In conducting pre-investment study the first step is to study the market.

It is understandable if in some developing countries the consumption pattern

has not been established in a form appropriate to the potential demand of the agricultural sector at that period of time. Previous experience in the use of pesticides should be observed and studied carefully. Meanwhile, new field experiments should be continuously conducted to evaluate the chemical pest control method suitable for a crop in a country/region.

In case ample funds are allocated to research activities for crop protection, it will be very wise to direct the research to integrated pest control covering all means and methods of control. However, the integrated research will be obviously time and fund consuming work. In this instance a preliminary study can be carried out while or without awaiting the definitive results of the actual research. The result of the preliminary market study will be useful for pre-feasibility study.

As it is necessary that the related problems (III.1) are to be taken into account in this market study, a group of experts consisting of the following qualifications will be needed:

- Chemical Engineer, with extensive experience in Pesticides Industry.
- Economist/marketing expert, with extensive experience in the marketing of pesticides.
- Pesticides specialist* which is usually represented by Entomologist or Plant Pathologist having broad experience in chemical pest control.

To include the aspect of distribution, the projection of demand is to be presented either by region and by type of crop as well. All quantities should be presented on the basis of active ingredient content. In presenting the type of pesticides suitable to a region's crop, besides the actual names and function/class, their suitable forms of formulation should also be reported. This form of presentation should be further converted to a form which are able to tell their chemical origin or from what intermediates (or group of intermediate) from which they are usually manufactured as well as by what diluents/carriers they are formulated.

The following system of chemical classification might be appropriate:

1. Inorganic
2. Organic:
 - (a) plant derivatives/botanical;
 - (b) chlorinated;
 - (c) organophosphorus;
 - (d) carbamate;
 - (e) others.

While the classes of pesticides can be grouped in the following system:

1. Insecticides and miticides;
2. Herbicides and plant hormones;
3. Fungicides;
4. Rodenticides;
5. Others.

The projection of demand is expected to be able to give the likely trend in the coming decade.

3. Feasibility Studies

It has been generally accepted that pesticides industry can be subdivided into two groups:

- (a) Formulating plant;
- (b) Manufacturing plant.

Usually in a developing country where pesticide market is not yet developed, (a) small formulating plant(s) producing ready-to-use pesticide formulations are promising to set up.

In case the market size has been economically substantial, an attention could be switched backward to consider the feasibility of manufacturing plants producing the technical materials to supply the input for the formulating plants. Either type of plant to set up, feasibility studies are to be carried out first.

In some cases these studies can be conducted in the following stages:

- (a) preliminary study;
- (b) detail study.

Preliminary feasibility study or pre-feasibility study could be either of national oriented or regional oriented basis. From this study it is expected that some promising projects could be identified roughly. If from the

preliminary study the government has identified a project which will promisingly give a great national/regional benefit to the country, region the project can be promoted to private companies or the detailed feasibility study of the project can be carried out by the government.

In case there were identified projects of insignificant benefit to the economy, the more detailed feasibility studies are preferably to be left to the interested investors. All the results of these studies can be then analyzed together in an integrated study on a national or regional basis to enable the preparation of the development programme of pesticides industry.

Some feasibility criteria

Specific feasibility criteria are necessary to set-up which will be helpful in the identification of new projects. Pesticide industry experts are expected to contribute ideas in this matter based on the most recent cost condition. The following items might be of great value as a guidance for project identification, e.g.:

1. Average minimum economic size for both manufacturing and formulating plant. By using this factor and the result of market study it is possible to analyze roughly the prospect of new projects.

2. Commercial profitability
A number of criteria such as: Percentage return on investment, pay-out period, capital to output ratio etc., are useful indicators for analysis.

3. National profitability
The following consideration is necessary to take into account in conducting project evaluation by the government:

- benefit/cost ratio (government viewpoint)
 - value added
 - domestic resource cost
 - foreign currency saving
 - capital intensity
 - other benefit to the national economy and development such as the increase of agricultural output, the multiplier effect to other economic sectors, the transfer of technology and skill etc.
- } reasonable limit of accepted values are necessary to establish

4. Programme for Implementation

The development programme of pesticides industry is to be concluded from the previous studies, on either national or if necessary regional basis.

Some suggested sectors to involve in setting up the programme are:

- (a) projected demand in the coming ten years, annually presented;
- (b) production potential of local pesticides factories in the same period;
- (c) minimum economic sizes of formulating and manufacturing plants based on local cost conditions.

The projected demand as it must be usable for preparing this implementation programme, should be convertible to three methods of presentation, i.e. a yearly forecast classified by:

- classes of pesticides
(insecticides, herbicides, fungicides, etc.)
- chemical classification
- form of formulation (solid, liquid).

By all of this information, programme for implementation could be drawn up to include:

- the target of development to reach
- to stages of development of pesticides industry
- what are the promising projects and when they are to be promoted
- how big are their sizes and the needed capital investment
- where are they to be located
- what are also the needed prerequisites and preconditions
- who will be preferably recommended to finance
- what are the expected benefits to gain in each step
- what are the follow-up measures required, simultaneously after the implementation of this programme.

- consumer's interest, purchasing power, and programme of crop production.
- intensiveness of pest control programme.

Note: All factors and premises constituting this programme are obviously to be realistically assessed by not missing the following considerations:

- implementability
- technical
economical
financial

IV. Promoting the investment

1. Objectives

The identified projects resulted from the previous studies are necessary to be promoted for investment. The capital investment for the projects is mainly intended for the private company's participation.

It is the government's policy to avoid or to keep its involvement in the project financing at a minimum, because the objective is, among others, to create the maximum participation of the private sectors in the national development with a minimum government expense.

Consequently, sound projects which are suggested and plotted in the development programme are to be made attractive to the investors by proper promotion.

All the project information, technical as well as economical, including what benefits to gain and the commercial profitability of the project are to be made available to the investors.

2. What projects are to be promoted

Only projects meeting the following requirements are to be promoted:

- Commercially feasible.
- Nationally profitable to the economy, giving a positive benefit to the country's economic and social development, especially those having likely advantages as what is termed as key industry.

3. How to promote

The first step of all in project promotion is the preparation of project presentation.

A systematic and comprehensive project information sheet, as commonly used for instance in the periodical UNIDO meeting for investment promotion, should be used.

Even, if necessary, an additional item on estimated commercial profitability or something similar could be mentioned, although it is out of the government's guarantee.

What facilities are provided by the government to the interested investor could also be mentioned.

However, there will possibly be some factors specific to pesticides industry projects slightly differing from other groups of chemical industries:

- Product obsolescence due to the relatively fast rate of invention;
- Local regulatory restriction, if any, specifically concerned with crop and human protection.

Those factors will obviously affect the period of marketability of product, which thus raises the risk factor of the project.

However, experienced producers have been aware of this. They have of course qualified experts to choose, for instance, the appropriate and flexible design of equipment; and they have also had their own minimum limit of acceptable return on investment or maximum limit of pay-out time.

However, due to the following factors:

- Its high risk both in safe-handling and in its market uncertainty;
- Its expected positive contribution to improving the economy through the agricultural sector of production;

a special treatment from the government as a compensation to the investor is deemed tolerable for incentive purposes. For instance in the:

- Requirements/prerequisites to meet for investment approval;
- Tariff and taxation, etc.

The next problems are:

- Who will promote;
- What are the media of promotion.

The Department of Industry, through its appropriate body or industrial information service, will obviously be in charge of promoting the projects.

Some useful media of promotion as provided by UNIDO are recommended to take:

- UNIDO Bulletin (news letter);
- UNIDO meeting for investment promotion.

V. Conclusion and recommendation

The conclusion and recommendation contained in this chapter have mostly been generalized, and so may apply to other developing countries.

- (a) The role of pesticides industry in a country of more or less the same situation to Indonesia will be having a significant contribution in the future to its economic development.
- (b) The sequence of presentation of this paper is more or less identical with the procedure of pesticides industry development in the developing countries - as suggested by the writer - consequently the development planning of pesticides industry will require the involvement of other related institutions, i.e. the Department of Agriculture at least.
- (c) The scarcity of skilled personnel and the lack of funds in most developing countries to carry out the over-all development planning of pesticides industry will obviously need technical assistance from other capable bodies/countries.
- (d) The following possible pattern of pesticide industries in a region could be considered for future development:
 - Formulating plants could be set up in each consuming country, while manufacturing plants need not exist in each country of the region;
 - The latter should be erected in an appropriate country to supply the technical material needed by the formulating plants in the surrounding countries.
- (e) The non-developed situation on related aspects of production and usage of pesticides in most developing countries needs to be cured promptly to protect the developing countries concerned against unfair commercial practices neglecting human safety.

(f) The stages of pesticides industry development in developing countries will start from the development of formulating plants.

After the market has been developed to reach the economic size of manufacturing plant, the development of the latter could be started.

(g) In conducting pesticide industry surveys, it will be more advantageous to carry out the regional survey first, then the national study will follow.

(h) In a specific condition and background of a country, this writer's findings may not be valid to apply. A different guideline could be applied, appropriate to the country concerned.

Recommendation

(a) To developing countries

- We could start to consider the preparation of regional planning of pesticide industry development.
- We are anxious to gain other developing countries' experience in conducting their development programmes on pesticide industry.

(b) To relevant United Nations bodies

- Developing countries need to be familiar with recent major progress and problems occurring in pesticides matters (production and application).
- Research activities on pest control in developing countries should also be directed to integrated pest control methods, and not only emphasized to chemical pest control method.
- Technical assistance provided for research and development might be multi-beneficial if partly channelled to universities, and under co-operation with the relevant department.
- UNIDO is requested to maintain its role in promoting the development of pesticides industries in the developing countries.
- Through the Technical Assistance/Aid Programme of UNIDO, some developing countries need to have laboratory facilities for pesticide residue monitoring.

(c) To pesticides producers

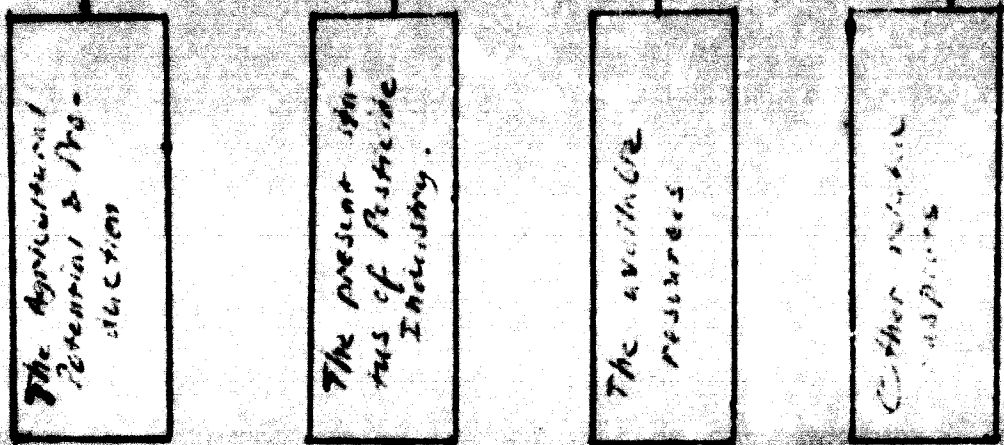
- In the marketing of their pesticide products in the developing countries not yet having sound pesticide regulatory restrictions, it is requested of them to behave as they do in developed countries, and not doing their business merely for maximum profit by exploiting the lacking situation of the developing country concerned.

(d) To developed countries

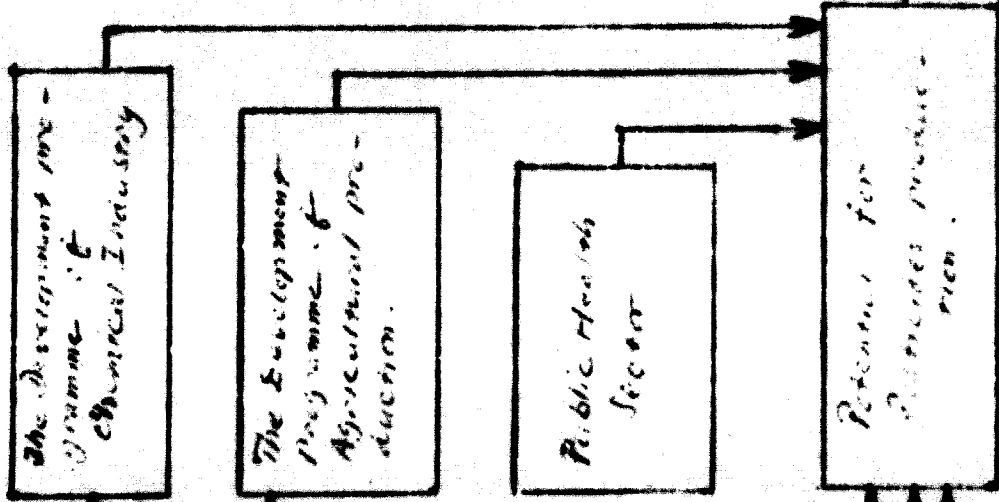
- It is recommended/requested to agrp-developed countries to provide also in their technical assistance/aid programmes, a media for the transfer of know-how on pesticides.
- The participation of pesticide producers in the country is also expected in achieving the above-mentioned request.

SUMMARY

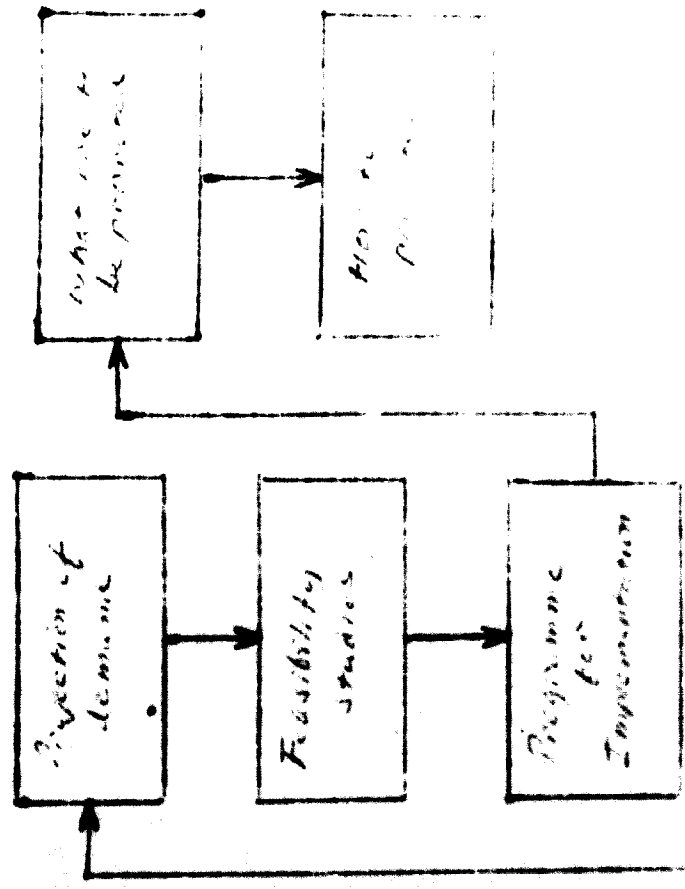
I BACKGROUND SITUATION



II THE PROSPECT OF PESTICIDES INDUSTRY



III PLANNING THE DEVELOPMENT OF PESTICIDE INDUSTRY



IV THE PROSPECT OF THE PESTICIDE INDUSTRY



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