OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

05458

Distr.
LIMITED

ID/WG.171/23
8 May 1974

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

International Consultation on
Agro-Industrial Development

Belgrade, Yugoslavia, 13-18 May, 1974

THEORY AND PRACTICE OF LONG-RANGE AGRO-INDUSTRIAL DEVELOPMENT WITH PARTICULAR REFERENCE TO FRUITS AND VEGETABLES 1/

A. G. Watson*

* Agronomist and Project Manager, FMC Corporation, California, USA.

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. This document has been reproduced without formal editing.

id.74-2786

CONTENTS

I. THEORY

The system's concept

Man's most important endeavour in terms of his survival and well-being is agro-industry; that is, agriculture and its related industries, supporting it, and processing, distributing and marketing its products. In its more modern forms agro-industry is a complex system of an inter-disciplinary nature: biology, ecology, geography, sociology, economy, ethnology and history embrace the factors which determine the nautre of agro-industrial systems.

An appreciation of the complexity of advanced agro-industry can be gained from an understanding of its evolution. Agro-industry was born when civilisation was born: when man first produced a reliable, storable surplus of food liberating some of his kind from the labour of finding or growing food and allowing the development of crafts and professions. This process began in Sumaria about 6,000 years ago and I believe that the date palm was the initial crop which provided that surplus. Agro-industry at that time was relatively simple and quite similar to that existing today in certain remote oasis communities. The farmers tended date palms, providing them with minimal care, water and protection from browsing animals, and also grazed sheep and goats. From the small food surplus produced he would barter with artisans, dwelling in the local community, and exchange their products for food. Each farmer raised one crop, processed it by, at the most, a very few simple ways, and bartered it in the local community for a few simple products and rudimentary services. Soon after this time, the value of grains (wheat and barley) grown under the protection of the palms was discovered, and the complexity of agro-industrial systems increased.

The needs of the farmer in pursuing his profession became more complex, as did the processing required, to enable each crop to be marketed, and the market itself. With each advance in agriculture and civilisation from then to the present day the complexity of agro-industry evolved. Today a single agricultural production unit, drawing upon diverse industries to supply materials and technology, might produce many products, which are

processed in even more ways, thus supporting a number of processing, packing and distributing enterprises and marketed perhaps on a world-wide basis. The agro-industry of a region is represented by the integrated efforts of the region's production units and all the related activities described above. It is an evolved system in which the development of certain aspects has been dependent upon the pre-existence of certain other aspects. For example, the existence of banana agro-industries in Latin America have led to the development of other tropical fruit, vegetables and ornamental plant industries using the capitalization of the primary industry. Many of the connecting links which relate a region's agro-industry to its biology, geography, ethnology, economy or sociology are traditional by nature, but nevertheless realistic today. For example, tea was introduced into Ceylon in the late 19th century because of the destruction of coffee by coffee rust; the production units, collection, transport and distribution systems and markets in the United Kingdom were already established for coffee and were used for the new crop. In a short time Ceylon became the major supplier of tea to Great Britain and this situation has prevailed, even though tea is not a native plant of Ceylon and tea is a relatively new and exotic drink for the British.

The fact that the success of an agro-industry is not entirely determined by an objective analysis of the factors operating today and the fact that agro-industry is <u>evolved</u> indicate the major problems that are encountered in developing agro-industry on a long-range basis. Long-range agro-industrial development implies establishing a complex more advanced system, or systems, of agro-industry in a pre-existing, less advanced, and/or less complex situation. Once established the developed system should be viable and develop within the integrated agro-industry of the region. Long-range development is quite different from short-range exploitation of a situation; in the latter case, the geographical, economic, sociological and biological position of a region is used to produce profitably a crop(s) without regard for the continued development of the agro-industry after the conditions, leading initially to the exploitation of the particular situation, have changed. The exploitation of the date palm in North Africa is a good example of short-term exploitation of the particular situation;

long-range development there is only now being considered. An agro-industrial system might be considered like a complex organ of the body working in concert with the other organs; a successful transplant is dependent upon great care being taken during the operation in making sure all the sustaining and significant links with the rest of the organs are correctly and expeditiously made. The organ itself must also be transplanted in its entirety. Just so with an agro-industrial system: a total system, comprising all the vital components needed to sustain it in the initial phases, must be introduced in its entirety plus sufficient flexible technology to ensure that viable, enduring links are made between the introduced system and the agricultural, economic and sociological environment into which the system is introduced. The preceding sentence, we believe, defines the prerequisites for successful long-range agro-industrial development. The experiences of attempting to introduce partial systems or combinations of a few machines and the problems encountered are so great that, today, work is only contracted when it is felt that sufficient parts of a total system and sufficient technology to ensure establishment of the system are included in the contract.

Hence successful agro-industrial development depends upon:

1) a comprehensive, in-depth knowledge of all the integrated factors of the agro-industrial system(s) to be introduced. This will include knowledge of the basic components supporting production right through retailing of the different forms of finished product and by-product.

2) a comprehensive, in-depth knowledge of the total relevant environment into which the system(s) is to be introduced. It is only through a thorough knowledge of 1) and 2) that the necessary adjustments can be made in the introduced system to ensure an enduring link with the total agro-industry of the region being developed. I must emphasize at this point that no attempt is made to introduce an exact replica of a Californian agro-industrial system(s) into a developing region. Certain aspects of the system must be modified to accommodate realities of the developing region. Some of these modifications are designed to overcome regional disadvantages (for example relatively heavier capitalization in terms of tomato harvest equipment

is necessary in Yugoslavia and Hungary compared with capitalization levels in California, because of the shorter harvest season available); other modifications are designed to take advantage of regional advantages (for example a beneficial rotation of vegetable crops with wheat can nearly always be planned in Eastern Europe, whereas in California we are forced very often into monoculture with all its related problems).

3) research capability, so that new situations and problems which arise can be understood and solved.

4) staying power, to nurture the developing agro-industry through the first critical years to ensure that the links established within its region and the links with the world economy, with regard to both imported material and/or exported products remain firm.

5) and finally of course, the existence of an organization capable of bringing together the needed material and personnel in the region to be developed and providing the contact and continuity to ensure the successful completion of the task.

II. PRACTICE

Over the past several years I have been involved in agro-industrial development in many countries of the world. On each project experience is gained which is applicable to the improvement of the next project. In the past errors have been made which can certainly be avoided today. A step by step description of current planning and implementation practice in a long-range agro-industrial development programme, with special reference to two recent projects in Yugoslavia and Bulgaria, will point out the most significant considerations, the most frequently met problems and their solutions.

Step 1. Overall analysis

Each country in the world is analysed with a view to its potential for agro-industrial development and its potential as a market for agro-industrial production. For this analysis, production, trade and market information from international organizations and national trade information centres are used together with significant economic data and resource information such as national climatic characteristics, size of production units, soil, water, labour and technological resources. The analysis is performed by computer, and data is updated as soon as newer information becomes available. The programme is designed to indicate areas of the world with the most potential for agro-industrial development and potential markets for the products of the development.

In the two projects cited above, considerable potential for processed vegetable and fruit agro-industry in Yugoslavia and Bulgaria has been found with major immediate retail and wholesale outlets in Great Britain, the Federal Republic of Germany, the Benelux countries, Scandinavia and bulk markets in the USA.

Step 2. Detailed analysis

Once regions of high potential for agro-industrial development are located and the markets desfined, a more detailed analysis of the region is carried out. During this analysis the particular agro-industrial system(s) which can be most readily and profitably developed is (are) defined.

At the same time, this particular system is studied in depth in its most advanced condition (most frequently in California) so that an intimate working knowledge of the components in the system and expected trends in its further evolution is gained.

The detailed analysis of Yugoslavia indicated that one agro-industry very worthy of development was the production of vegetables for processing, particularly tomatoes, green and dry beans, green peas, carrots, potatoes, onions, peppers and cucumbers. The development of green asparagus and sweet corn agro-industries was shown to have great potential in the near future. Agro-industries based on fruit, strawberries, peaches, apricots and grapes also have a high potential. Not surprisingly the Bulgarian analysis was very similar.

Step 3. Preliminary visits and contacts

Contact is then made with agro-industrial planners within the subject region and data is gathered locally to assist in site selection for any proposed development project. At this time, the scope or comprehensiveness of the system that might be proposed is decided. A thorough knowledge of the local and national conditions is desirable at this stage so that the links that will sustain the introduced system and engage it with the local economy can be ascertained. The projected agro-industrial system can then be modified to accommodate the local links. Final biological and economic feasibility studies are completed at this step and contact made with potential clients interested in long-range agro-industrial development.

In Yugoslavia, in 1972 preliminary visits and the gathering of local data resulted in to the conclusion that, amongst the fruit and vegetable crops, tomatoes, green beans and peas should be developed at the selected site in Macedonia. Tomato paste, juice and some peeled tomatoes, canned whole and cut green beans and canned peas were envisaged as the most profitable products with emphasis on the export market to Western Europe. There were also indications that development of agro-industrial systems based on fruit and grape products could be highly profitable.

In Bulgaria in 1973 tomatoes, green beans, cucumbers, pepper and onions marketed in Western Europe in diverse processed forms, appeared

to be the most attractive items amongst the vegetables for agro-industrial development. Peaches, apricots, pears and apples were the most promising of the fruits in this region for the development of profitable agro-industry.

Step 4. Proposal and contract negotiations

A proposal is now written to undertake the agro-industrial development at a particular production unit selected in Step 3. The aim is always to provide the developing agro-industry with sufficient links with the local environment and to train local management and technical personnel so that the agro-industrial system(s) becomes established and continues to develop and evolve within the environment into which it is introduced.

In some cases contract negotiations with the potential client bring one to the sad conclusion that the client wishes one to introduce insufficient parts of the total system to ensure the establishment of the new agro-industry. It has been found better, in these cases, not to complete a contract, rather than attempt the impossible and almost inevitably disappoint the client and frustrate our own personnel.

A problem which often arises and which has intensified in recent years has been the late finalization of contracts. When the contract is signed only a few months before the work is scheduled to begin the task of assembling the complex array of equipment and material and appointing specialist personnel has to be rushed. This can seriously jeopardise the success of a programme of agro-industrial development.

Step 5. Implementation

This step can be more easily considered when it is broken down chronologically into its component phases, which are the subject of the following chapter.

III. IMPLEMENTATION PHASES

1. Personnel Selection. During the proposal and contract negotiating step a project manager is appointed. By the time the contract is signed this man is thoroughly familiar with the agro-industrial system which is to be introduced and the major areas which require specialist technical assistance and counterpart personnel training. On this basis a team is assigned to implement the project. This is one of the most critical phases because the success of the project will depend upon the ingenuity, adaptability, conscientiousness, motivation and diplomacy of the team members. During the actual implementation it is often the case that additional personnel in other areas of expertise are required and these are appointed as the need for them arises. It has been found that the implementation of Agro Industrial Development projects is very demanding on personnel and that experienced and successful personnel in this field are difficult to find.

2. Detailed on-site data, material and labour requirements

The project team will prepare a list of the specific additional data required from the project site to make the detailed plans for the project. The team will also submit a list to the client of the equipment, material and labour which the client is expected to provide and which is felt to be necessary for the success of the project.

In the past these lists have been submitted to the client who is relied upon to supply most of the agricultural chemicals and farm and factory support equipment and machinery. In future years, however, it is very probable that these chemicals will be included in the contract material, as the inavailability at a decisive juncture has been known to cause severe problems, such as the difficulty of controlling the colorado beetle, Leptinotarsa decemlineata, on tomato seedlings.

3. Equipment and material purchase, packing, transport, delivery and assembly

This is a very important phase of successful agro-industrial development. Delivery dates for equipment are very often critical for the success of a project and in these cases good contacts with supply and transport companies are essential. Even with these contacts, it is

difficult to ensure that all the equipment will arrive on time, there are inevitably cases of delay in transport and this year shipments were delayed by a U.S. truckers strike.

Rapid unloading and assembly is therefore needed in most cases. An unloading and assembly site is chosen and the necessary cranes, fork lifts and labour is organized at this site for the arrival of the machines. As the machinery arrives, together with appropriate spare parts an accurate inventory must be established. It has also been found that the organization of the spare parts in an indexed magazine greatly aids operations.

4. Land preparation. It has been generally observed in the development of fruit and vegetable agro-industries that field layout and land preparation are areas most in need of improvement in regions being developed for such systems. Briefly, an attempt is made to lay out intended fields at right angles to the farm roads, wind breaks and irrigation systems. This minimizes odd shaped fields and point rows. The land very often needs extensive levelling, especially for vegetable growing, and the proportion of land preparation work performed in the fall compared with the spring is greatly increased. Subsoil chisels are used to break up the plough pans that are extensive in the grain growing lands of Eastern Europe; two-way ploughs are used to avoid the formation of dead furrows.

Most important for vegetable production is the use of the bed system and direct seeding. All the land preparation operations are designed to integrate production of uniform, well filthed beds containing optimum water for seed germination and emergence, optimum fertiliser amounts and placement and optimum control of soil borne insects and diseases. The need for uniformity of bed conditions cannot be stressed too greatly.

There is no set sequence of mechanical operations that will produce optimum soil conditions for planting vegetable seed, this will vary with soil type and the weather. A general plan might be, in the fall:

i) Dispose of previous crop residue.
ii) Offset disc, 2 times.

iii) Subsoil chisel to break plow pan, improve drainage.

iv) Level several times with land plane.

v) Two way plough.

vi) Disc or cultivate with harrows attached.

vii) List into rough beds applying some fertilizer and allow to overwinter.

viii) Next spring - bed harrow.

ix) Tilth and plant seed applying starter fertilizer and preplant herbicide at the same time.

In both the projects under discussion the greatest problems in the first year were the lack of fall land preparation and the unlevelled condition of the fields.

In addition there was a distinct ploughpan in our care which could not be broken in the spring because of the wet condition of the soil. The presence of this plough pan prevented the use of the offset disc for weed control because of the additional compaction caused. Both areas were seeded later than was desired because of the additional time needed for land preparation, and the beds were not ideal. In the second year's operation, following fall land preparation, this condition will not recur.

5. Choice of varieties and planting schedule

The varieties of fruit or vegetables are selected during the analysis steps. The choice is determined by estimated adaptability of the variety to the region and the need to prolong a uniform harvest season for as long as possible to maximize the use of the harvest equipment and processing facilities, and reduce labour peaks With fruit stock the harvest period is extended by the use of different varieties, chemical and physical pruning techniques and by ripening chemicals. With vegetables, the harvest period is extended by use of different varieties, different plant densities, fertilizer and water application rates, ripening chemicals and by a planting schedule. In addition with certain vegetables, such as tomatoes, a certain percentage of the total area is planted with transplants for the first harvest. This percentage varying with the region: in Hungary we recommended that about 20 per cent of the area of tomatoes should be transplants, in Bulgaria 10 per cent and in Yugoslavia about 15 per cent.

In one project last year the use of different tomato varieties and a planting schedule, even with the late start in planting, gave a harvest period from August to October 12, whilst in the other project the tomato harvest period is planned from August 10 to October 10.

6. Factory Preparation. During the same time that the planting schedules are developed the existing factories are visited, surveyed and changes made to receive the products at the rates and times determined by the planting schedules. In our experience this is one of the real problem areas. For example, plans were made that the tomato fruit be supplied to two factories. Both were visited and surveyed and encouraged to build bulk reception facilities in early spring. However, by the harvest time neither had such facilities, instead they supplied 25 kg boxes into which the tomato fruit from the harvester had to be placed. Some belated attempts were made to receive fruit in bulk, but did not succeed.

As a result of the failure of the factories to gear for bulk reception the whole harvest was slowed to such an extent that a very large percentage of fruit on the field rotted before it was picked. In addition, the factories could not handle the amount of fruit harvested in boxes, so very soon all the boxes were waiting, full at the factory for emptying. Harvesting had to stop completely for several days and the quality of fruit, which had been standing in boxes for several days before being processed, was poor.

In the other project, however, better results are expected: indeed the factory is in the process of building bulk reception facilities based on our recommendations, so this weak link in development may be partially solved.

7. 7. Irrigation. The initial surveys determine the method of irrigation suitable for the crops and applicable in the project site. In some cases complete irrigation systems have been installed for the development of an agro-industry; this has been the case in North Africa and the Middle East. In Eastern Europe established systems are often modified. In both fruit and vegetable production the major problem has been with achieving precision, uniform applications of water with respect to time and space.

In a fairly typical case the fields were not level and sprinkle irrigation was used. The water applied for emergence was applied at too high a rate and gave a crust which caused non-uniform and poor emergence and some herbicide phytotoxicity. Some areas of the field remained dry during the first irrigation and the seed did not emerge until the second irrigation, hence the stand was non-uniform. During the later irrigations, rivers and lakes were produced in the fields because water was applied at too high a rate. Some tomato fields were overwatered and watered too late resulting in loss of much fruit by cracking and rotting and some fields were not watered frequently enough resulting in loss of fruit from blossom-end-rot.

Irrigation systems and patterns should be designed so as to achieve optimal water conditions in the root zones of plants at the different periods of growth. Precision placement rate of application and timing all contribute to this important phase of culture.

8. Weed control. The development of agro industrial fruit and vegetable systems inevitably implies increased use of chemical weed control materials. The two major problems in this area which frequently occur are: (i) unavailability of materials,

(ii) non-uniform application rates caused by lack of experience.

As described earlier, steps are being taken to overcome the first problem. The second problem can only be resolved by patient training of farm personnel and the use of modern application machinery. In one project there was a case of phytotoxicity because the containers were wrongly labelled but otherwise herbice use was good.

9. Disease and Insect control. As with weed control, chemicals are more widely used in disease and insect control in modern fruit and vegetable agro-industry.

Great success has been enjoyed through the use of the most effective chemical to do the job, the use of uniform, rapid application equipment so that large areas can be treated very quickly with the correct dose of chemical and the use of spray intervals determined, not by the calender, but by the climatic conditions and crop situation. In other words, treatment is according to the intensity of the disease or insect threat.

Last year in one project after an initial problem in tomatoes with

controlling colorado beetle, Leptinotarsa decemlineata, because an effective chemical was not rapidly available, no serious disease or insect problems arose on the tomatoes, green beans or peas.

With all chemicals, weed, insect and disease control, and ripening agents, the problem of national registration of chemicals has arisen, different countries have vastly different laws of registration. In view of the importance of correct chemical registration to the well-being of the whole world and the expense of the process, here is an obvious area where international co-operation, through an organization such as the World Health Organization, could standardize the present chaotic situation to the benefit of all.

10. Cultivation. With the development of agro-industrial systems larger blocks of fruit and vegetables are grown under mechanized conditions. Timing of the crop is critical so that more precision is required in cultivation, both with respect to timing and proximity to the crop plants.

11. Fertilizer applications. In initial surveys and analyses of the soils in which the production is to take place the quantities of essential plant nutrients and micro element is determined. The quantity of fertilizers applied is determined by the results of these analyses and the crop to be grown. Again because of the critical timing of the crops the amounts, uniformity and placement of applications is very important, and a system should include the use of equipment to precision-place applications of fertilizer in the root systems of the various crops.

The lack of availability of good granulated fertilizer for use in this equipment has proved to be a problem in both projects. In future projects it will probably be wise to include fertilizers suitable for precision application in the contract material.

12. Harvesting. East European countries are well experienced in mechanized harvest of non-perishable, or relatively non-perishable products such as grains, sugar beets, potatoes, but the machine harvest of perishable items is a fairly new concept. All through the crop culture from variety selection, crop planting until harvest, the objective should be a prolonged, uniform harvest of product in optimum condition. The harvesting is no less important an operation in ensuring that this type of harvest can be achieved.

One problem that is always encountered in the first year of development in the reluctance of the farmers to begin the harvest early enough. The mechanised harvest of fruit or vegetables must be considered in its entirety and the harvest of a single day or single planting is just part of the harvest. For example, with tomatoes, as with many fruit and vegetable crops, it is not wise to wait for one block to achieve maximum ripeness when the machine must afterwards work in other blocks which, by then, will all be over-ripe. The harvest schedule is determined by the projected rate of ripening of the whole crop over the whole harvest period. It is better to lose production at the beginning because of a sub-optimal percentage of ripe fruit than to lose production at the end because of an over-ripe state. In the former case, the overall quality of produce will tend to be better and in the later case the harvest tends to get slower and slower as the fruit becomes overripe and less managable.

The situation with regard to harvesting tomatoes, green beans and peas in one project in 1973 was much as described above, yet the rate of harvest did not keep pace with the rate of product ripening. However, production units rapidly assimilate good harvest scheduling techniques and this year recurrence of this problem is not anticipated.

13. Bulk Transport. Again, bulk handling of perishable fruit and vegetables is relatively new in most of Eastern Europe. As yet bulk transport facilities are not usually included in contract equipment because it is felt this is more economically sourced locally. In consequence this connecting link has often been weak in the first year.

Bulk transport systems differ with different crops and a number of designs will suffice for any one crop. For tomatoes, for example, one can use box pallets of about 400 kg., 4 ton trailers or 10 ton gondolas on flat bed trailers. The only requirements that should be met are:

i) The fruit should not be stacked higher than one metre.
ii) Sharp edges, rough sides or cross bars should be avoided.
iii) Rapid transport and rapid, gentle, water assisted unloading, should be possible at the factory.

In one project a bulk transport for tomatoes could not be used because unloading facilities were not available. In the other a bulk transport system will be constructed to handle 8 - 10 loads of tomatoes.

14. Processing. Generally upon introduction of a fruit and vegetable agro-industrial system into a region of Eastern Europe, the existing factories are found to be accustomed to dealing with the hand-harvested production of other varieties. The new varieties, delivered in bulk, in machine harvested condition, are naturally different from the traditional hand-harvested varieties delivered in small boxes. Invariably, the factories have problems dealing with the produce. This is particularly true of tomatoes since most characteristics of the tomato which are favourable for mechanization of tomato production are unfavourable for its processing. Ideally modern processing factories should be built to be ready to accept the production of the new system. This is the case when agro-industry is developed in a virgin area, but in regions with existing agro-industries there is naturally the desire to modify the existing facilities to accommodate the first few years' production before new processing facilities are built.

The adaptations which have to be made to existing factories are largely concerned with bulk reception, pre-cleaning, disposal of waste and cull material, additional sorting lines and increased daily capacity of total processing lines. There are also many specific changes which should be made for different crops to improve the quality of product but these changes are often best accomplished when the new processing facilities are built.

In long-range agro-industrial development of virgin areas production and processing (and incidentally, marketing) are scheduled to come on stream simultaneously, but in areas with existing agro-industries sequential development is recommended.

First year - develop fruit or vegetable production at farm site and deliver to local existing factories.

Second year - continue same size production at farm 1 and build processing complex with greater capacity than can be filled by farm 1. At the same time develop production on farm 2 to complete the capacity of factory 1.

Third year - increase production at farm 1 to satisfy factory 1. Build factory 2 near farm 2 but with greater capacity than farm 2. Develop production in third area, farm 3, to fill the remaining capacity at factory 2. And so on.

The result of this type of development is a number of areas within a region, each one with one processing complex satisfied by nearby farm production. There are several advantages of this system:

i) Surges in production in one area can then often be handled by the factories in the other areas.

ii) The special characteristics of each area can be accommodated, for example, one area may be able to consistently begin harvest two weeks earlier than another nearby area; if processing were too centralized the large factory for the whole region would have to be ready on the first harvest date whereas with area centralization, only the factory with capacity for the early area will open.

iii) The transport distance for perishable products is reduced by the area processing plants.

iv) Labour deployment problems are often eased by the less centralized system, especially in developing regions.

15. Experimental Programme. An extensive experimental programme should always be included in an agro-industrial development project. This programme should include experiments on new varieties of fruit and vegetables on all modern aspects of culture and on different processing techniques.

The experimental programme completed in 1972 in one project on varieties and fertilizer rates in tomatoes and green beans provided useful information which has been used to improve tomato and green bean culture this year. In the other project, a wide range of experiments have been planned on herbicides, fertilizer, rates, planting dates and high plant densities for tomatoes, green beans and cucumbers.

The farming unit is encouraged to establish its own experimental programme so that the newly established agro-industry might continue to develop.

16. Documentation. Good internal documentation during the implementation of a programme of agro-industrial development is essential. This facilitates communication of concepts and specific recommendations and reduces duplication of effort and misunderstandings. Serially numbered forms, with carbon copies, are used for internal documentation of

development projects.

A full technical report of each project is also prepared; its primary function is to point out areas for improvement and to record the progress made during the programme. Recently color photographs have been included with the final reports illustrating some key features of the project. In the near future the possibility of supplying video cassettes, showing actual operations at the development site and the same operation, performed in an optional way elsewhere, has been considered.

17. Training. The training of personnel to carry on the development of the agro-industrial system after a project is completed is considered to be one of the most important phases of work. This training is carried out through theroretical classes and seminars, by field days, by constant on-the-job instruction, and by organising study tours for technical and management personnel to observe advanced agro-industrial systems in the USA, particularly California.

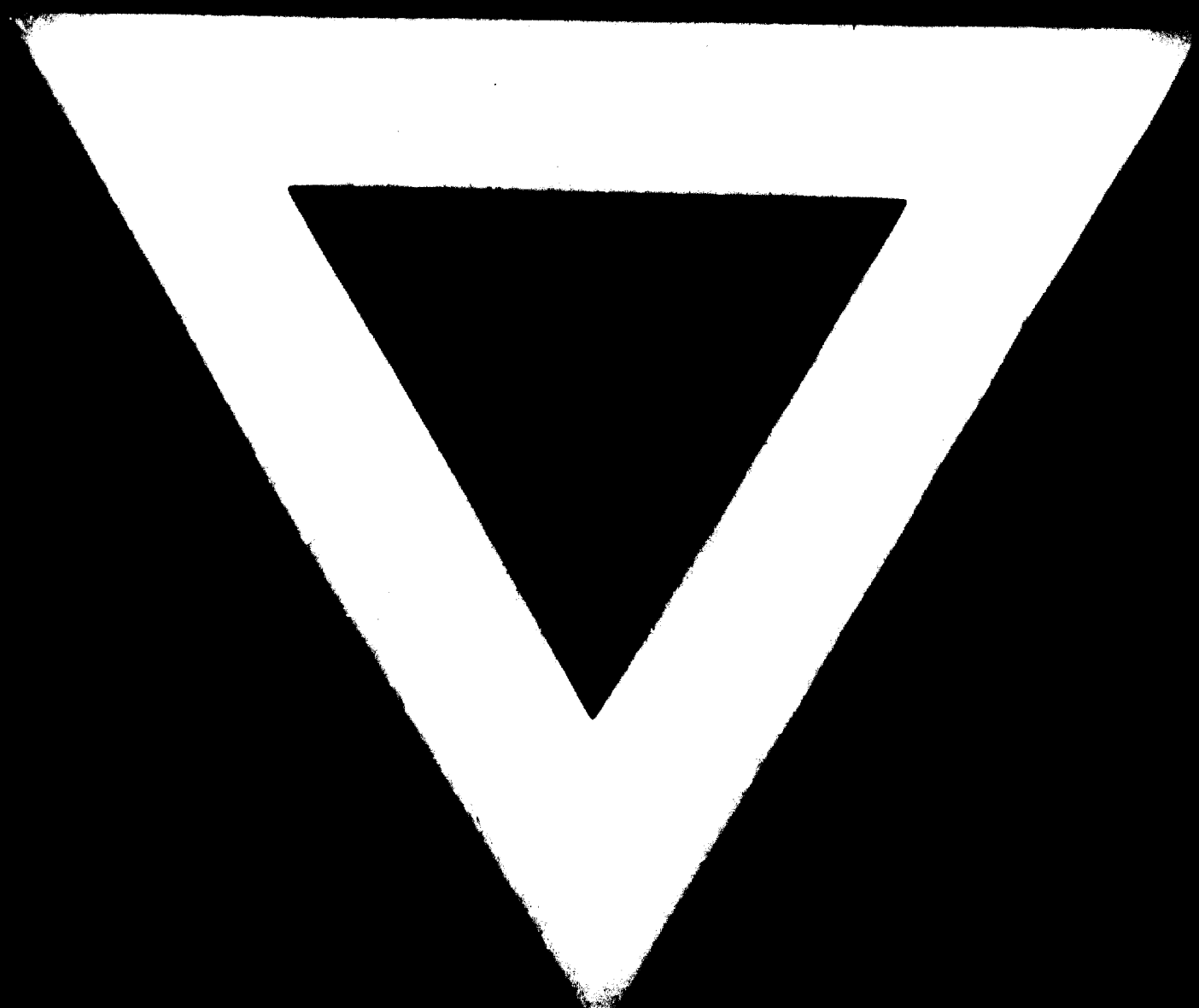
18. Continued Support and Responsibility. Another very important phase is continued support and interest in an area after a particular contract is completed. Though the contract period is for 1, 2 or 3 years, nevertheless special attention should be given to that region in the following years to ensure that the system has been established and continues to develop.

When a contract is completed an attempt is made to set up a spare parts system and to visit each area at least once a year; this phase has been difficult this year because of the oversold state of agro-industrial equipment in the USA, which has put lead times on certain spare parts of more than one year. Spare parts, seed and chemicals should be ordered a year ahead if at all possible.

IV. CONCLUSION

In conclusion, it should be stated that the systems approach to agro-industrial development, using a team of experts and detailed pre-implementation surveys has scored some notable successes. In a world needing continually to expand its food supply this is an encouraging conclusion. I would add a personal note: long-range agro-industrial development work is very demanding in all its phases but it is also very satisfying. I know that all the people with whom I have worked take a deep interest in each region in which they have worked and consider the collegial friendships established during the implementation stages highlights of their professional lives.

* * * * *



74.10 .1