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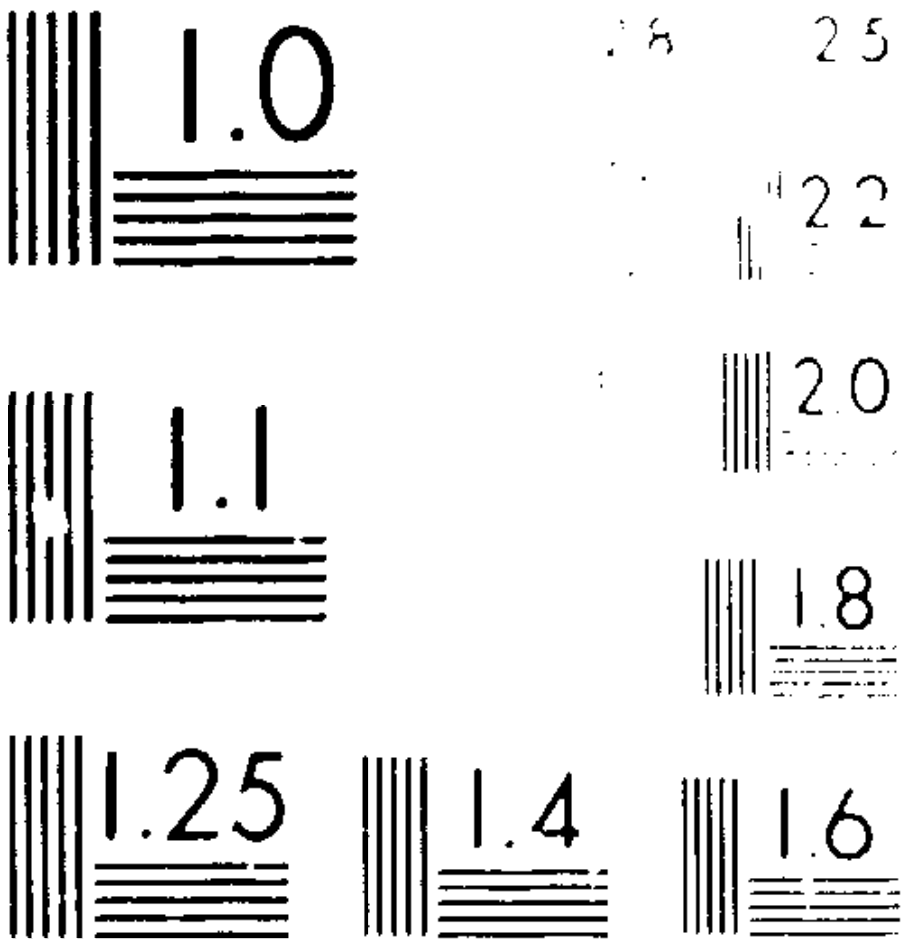
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ID/WG.219/5
24 October 1975

United Nations Industrial Development Organization

Original: ENGLISH

Regional Consultation for the Arab Countries of the
Middle East and North Africa on Licensing of Technology
with Reference to the Petrochemical and Fertilizer Industries

Tripoli, Libyan Arab Republic, 1 - 6 December 1975

Organized in co-operation with

Industrial Development Centre for Arab States (IDCAS)
General Organization for Industrialization, Libyan Arab Republic

TRANSFER OF TECHNOLOGY IN THE FERTILIZER INDUSTRY[1/]

by

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CONTENTS

I. TECHNOLOGY TRANSFER - ITS GROWTH

The concept of process licensing as a means of promoting technology transfer has expanded considerably during the last twenty-five years to the extent that it has become an accepted part of the international industrial scene. Considerable national benefit can be gained from licensing; the UK earned over 220 million pounds sterling in 1971 from licence royalties and fees. In the same year the UK paid out less than 175 million pounds sterling for the import of licence rights. The United States - a pioneer in the concept of selling ideas - earned nearly 900 million pounds in the same year. It is likely that the UK and the United States are the only two western countries with a favourable balance in the marketing of licence rights. Presently international licensing business is growing at a rate of 15-20 percent annum. The Licensing Executives Society was founded in the United States in 1965, it now has a membership of several hundred executives throughout the world. The first International Conference and Exposition on licensing was held in New York in January, 1973.

The growth of process licensing in the chemical industry has occurred principally in the fertilizer, petrochemical and organic industries. A recent listing of process technology numbers over 1,200 processes, 600 products, and nearly 200 companies offering process licences. It is sure that this listing is by no means complete.

The development and rationalization of process licensing as a means of technology transfer stems from a number of factors, all related to the need for the growth of the chemical industry in a competitive environment. Technology has become complex as the need for standardized products manufactured in large factories operating with economy in feedstocks and services, and with due attention to the environment, has developed. Processes for large tonnage products such as fertilizers where the chemistry is often relatively simple are becoming increasingly difficult to evolve, and success is frequently uncertain or slow to appear. A situation has arisen in which the invention of new and more efficient processes is so expensive that only large companies with proven and expanding markets can afford the substantial Research and Development facilities. Even in these cases, research does not always indicate a route compatible with market objectives so that even a large company with some in-house technology will find that the acquisition of a licensed process is usually faster and more certain.

The older concept of engineering companies maintaining significant R & D establishments, and having proprietary licensed processes in their own right is becoming less significant. Continued development of such processes is related to adequate technological feed-back from commercial operation by the process licensees, this is frequently difficult to maintain, especially where important innovation is concerned for which the licensee might have a sense of ownership which he is unwilling to share for other then commercial reward. Nevertheless there are a few companies - principally in the USA and Europe - which maintain an important development activity.

A recent development which is likely to modify the current pattern of international process licensing is the growing tendency of those countries undergoing technological development to make use of and indeed export indigenous skills and technology. Limited "hard" currency, foreign loans, and especially the political desire to be less dependent on the developed areas are important factors. The indigenous process technology of these countries may not always be the most advanced, but the desire to be independent must be recognised. Indeed there are a number of attractive processes already available internationally for the fertilizer industry which have been developed by certain of the CMEA countries. In particular, the East German nitric acid process, the Polimex sulphuric acid process, and general fertilizer processes of IPRAN should be noted.

Whilst the benefit of process licensing to the chemical manufacturer, and to process technology in general is established, it is pertinent to consider the benefit that can accrue to the successful process licensor. It has often been said that the main incentive for a company entering the process licence industry is the derived income which can be used to support or intensify R & D activity. The main justification for R & D investment by a chemical manufacturer is nevertheless based on the pay-off from the manufacturer's own production operations and the overall advantage of process licensing is a summation of various technological and commercial factors. Although licensing is growing in importance every year, it cannot be assumed to be advantageous in every case to a company owning saleable technology. Where modern technology is used to manufacture products that can be more profitably exported, both the interest of that company and its country's overall balance of payments can often be best served by the sale of products rather than encouraging unnecessary competition through the sale of a process licence. There can be little doubt that the profit from the sale of fertilizer to another country is much higher than that from the sale of process know-how for the equivalent installed plant capacity. The breaking down of international barriers through the grouping of countries in economic units will be bound to influence licensing policy. On the other hand, process licensing in

certain chemical manufacturing areas is so competitive that the withholding of a process licence to a potential manufacturing competitor will only result in the provision of equally good - or even better - know-how from another source.

Perhaps the most important advantage of process licensing, and one in which the philanthropic implication is most apparent, is the feedback and exchange of know-how which encourages further licensing and the development of new technology. Other advantages are:

1. Financial reward for minimum capital involvement.

2. Control by agreement over the licensee's territorial export rights (with certain exceptions).

3. The possibility of product sales for market seeding whilst the licensee's project is being developed.

4. Establishment of an eminent situation which dissuades other process licensors from developing competitive processes.

5. Opportunities for equity participation and joint marketing activity.

6. Stimulation of R & D activity.

7. Development of staff in the handling of projects.

There is every expectation that process licensing will continue to grow at a rapid rate. The establishment of large international chemical corporations, coupled with the parallel development of international engineering corporations assures a firm future. Process licensors on the other hand will rise and fall in accordance with their ability to develop and commercially exploit new technology and processes. There can be no future for a process licensor unless he has access to a strong and forward looking R & D facility.

II. TECHNOLOGY TRANSFER IN THE FERTILIZER INDUSTRY

The sale of technology in the fertilizer industry started to grow during the early part of 1950's, when the industry was entering a phase of expansion in which there was a trend towards more ownership and control of the basic raw materials and intermediates. Previously, apart from superphosphate production, other important intermediates such as ammoniacal liquors and ammonium sulphate were purchased as by-products from other industries. Engineering companies with mechanical handling experience erected mixing, granulation and bagging

plants to broad specifications from the fertilizer manufacturers, and in doing so gained worthwhile experience which was worked into the simple design concepts which then existed. An interesting feature of the pre- and early post-war era was the development of proprietary machinery and process equipment, rather than proprietary processes. The various superphosphate dens - Keller, Broadfield, Moritz, Maxwell, Oberphos and so on are typical examples.

This period also marked a significant expansion in the use of phosphoric acid and its derivatives as a route to higher analysis straight and complete fertilizers. Dorr Oliver Inc., or the Dorr Company as it was then known, was a notable pioneer in the production of wet process phosphoric acid, granular triple superphosphate by the slurry route, and ammonium phosphate based granular fertilizers. This company became the leading engineering company with "in-house" phosphate technology, with many plants throughout the world. Indeed, the major fertilizer manufacturers in the UK have operated Dorr Oliver processes for several years. As time passed, fertilizer manufacturers gained experience and developed their own techniques and expertise to cope with the variety of raw materials and products typical of the industry. In particular, the availability of new phosphate rock sources each with its unique characteristics in such aspects as phosphate rock dissolution rate, free sulphate level, gypsum filterability, and system [illegible] properties, encouraged the larger manufacturers in Europe to develop know-how of considerable value. Several of these manufacturers have now licensed their know-how for many years. In the USA however, with its dependence on indigenous phosphate rocks of more uniform and predictable quality, the virtually standardized large plants with a limited product range, and the growth of bulk blending, there has been considerably less scope for activity in the licensing field by the fertilizer manufacturers, so that the engineering companies continue to provide an adequate service with their existing "in-house" technology.

The Tennessee Valley Authority with its well known fertilizer R & D activity has played an important role in the US fertilizer industry; its developments in the technique of ammoniator granulation, granular DAP production, and liquid fertilizer technology, commercially pioneered in the USA, are now used throughout the world. TVA assistance and the use of its inventions are freely available to engineering companies and fertilizer manufacturers. Engineering companies offering TVA processes however are responsible for all aspects of the plant design and carry full liability for successful operation. A major disadvantage in obtaining plant and equipment from engineering companies with only "in-house" processes is frequently the inability of the company to provide the peripheral but important areas of assistance which are normally available through the established operating companies which

provide a licensing service. Such aspects as long term production operation, reliable process operating data, knowledge of maintenance procedures, training of the licensee's staff, "after-sales" service, etc., are valuable adjuncts to the process licence package.

Engineering companies with "in-house" processes have maintained a leading position in nitrogenous fertilizer technology - much more so than in the phosphate intermediates area. There are fewer operating companies which offer process licences for ammonia, and nitric acid production. The relatively pure and limited range of feedstocks for these processes allows the operating company to assume that process design concepts, equipment specification, and operating procedures have long since been standardized. Although this assumption is not always justified, it does not seem likely that the majority of operating companies devote any significant R & D activity to the up-dating of nitrogenous fertilizer process technology other than for essentially "trouble shooting" aspects.

During recent years, the process engineering industry has seen an amalgamation of both national and international interests as a means of maintaining and developing business. There can be every expectation that the rationalisation of this industry in such manner will continue. It is possible that by the end of this decade there will be perhaps only two or three major companies of international status in the UK. Such consortia by virtue of their historical development may well have access to overlapping licensed technology from several sources.

In such circumstances, there may well be an incentive for a similar rationalisation of process technology, particularly where the various sources of know-how are owned by the engineering company. It can also be expected that engineering companies will be increasingly selective in their sub-licence arrangements with operating companies having saleable processes. Fertilizer plants are expensive and require substantial engineering services. The process engineering company plays an important and often indispensable role in the conversion of an operating company's process into a physical reality. Most fertilizer process licensors therefore maintain formal long term licensing arrangements with a limited number of engineering companies capable of operating on an international basis, and with the minimum of support. The success of a process licensor is greatly dependent upon these relationships.

III. SELECTION OF PROCESS TECHNOLOGY

There are two well-designed stages in the selection of the most attractive technology for a production unit or complex. The first stage is concerned with the evaluation of the various process routes that are available, and the selection of the route which most closely meets the overall requirements of the proposed production route with respect to feedstocks, by-product disposal, product quality, etc. The second stage is essentially concerned with the in-depth evaluation of the various processes which are available and commercially proven for the process route already selected.

Process routes used in the modern fertilizer industry are few and well established so that the first stage - process route selection - is simple. For example, the vast bulk of the world's nitric acid capacity is based on the oxidation of ammonia. Similarly, phosphoric acid for use in fertilizer production is largely based on a route which depends upon the dissolution of phosphate rock with sulphuric acid. Even the integration of individual process routes and processes into a total factory complex offers only a limited opportunity for unique or novel solutions.

The second stage - process selection - is not simple. Although there are only a few commercial processes available for the production of fertilizer intermediates and products, careful evaluation is need if the proper identification and measurement of individual process benefits is to be achieved.

Selection of process technology in the phosphatic fertilizer sector is often arduous and has a high risk factor, this stemming from the nature and source of the principal feedstock - phosphate rock.

The usual approach to process selection is concerned with the assignment of monetary values to feedstocks, products, utilities chemicals and catalysts, etc. Estimates or prices for the total plant are obtained, together with those for labour requirements, maintenance, taxes, finance charges, loan repayments, etc. Individual processes are compared, and the one that shows the highest return on investment becomes the logical choice. Care must be taken however to ensure that individual process selection will be compatable with the requirements of the overall fertilizer complex. In a phosphatic fertilizer complex, the selection of process technology for the sulphuric acid and phosphoric acid units must be made within the context of an overall optimization exercise. The "new generation" phosphoric acid processes can produce a concentrated phosphoric acid without the need for steam evaporation unit. The benefit of a "new generation" process must therefore be weighed against the economic contribution

that can be obtained with the export steam from the sulphuric acid plant, this is not always an easy task.

There are at least six active and successful licensors - all operating companies - presently offering wet process phosphoric acid technology. The essential differences between several of the processes appear to be minor to the lay person.

Indeed, processor licensor selection should properly take account of the more important peripheral factors such as proven commercial exploitation on a range of phosphate rocks, adequate demonstraction of plant utilization, knowledge and ability to deal with the unique and complex corrosion aspects, availability of licensor's expert staff. All these factors can combine to outweigh intrinsic process attraction.

Process selection in the fertilizer industry can be a difficult task and there is no orderly and straightforward procedure. As the centre of interest moves towards the emergent countries, such features as the provision of hard currency financing, equity participation, ex-patriate management, and joint marketing ventures also become important considerations.

IV. LEGAL AND COMMERCIAL ASPECTS OF TECHNOLOGY TRANSFER

Know-how and patents are abstract forms of industrial property, the sale of which demands a different approach to that for the marketing of merchandise. An important pre-requisite to the successful selling of know-how is the adequate protection by law against misuse of the transferred information and rights. The transfer of know-how is not merely an exercise in law, the licence contract exists to define the obligations and rights of the participants. These are commercial and technical matters involving business people, technologists and engineers for the successful implementation and servicing of the terms of the contract. Corporate management is now aware that licensing is a business function in its own right, and that it is no longer merely a legal or patent by-product. The modern trend in licensing, as in other business activities, is toward the development of scientific management through the formulation of a well defined licensing policy, and the assignation of the licensing function to a senior executive or department whose measure of success is measured by profitable marketing of licence rights which can be fully supported by the legal function.

It is worthwhile at this stage to consider the status of technology as industrial property. The material negotiated in a licence agreement exists largely as intellectual property which can usually be characterised into three main forms. These forms are historically evolved concepts in the transaction of intellectual property which require formal expression in the licence agreement.

A. Patents

A patent is an exclusive right of monopoly granted by the State to an inventor for a specified period of time in recognition of a novel and useful invention or development. During the life of the patent, the patentee has the right to:

1. Use the patented invention or not at his own discretion.

2. Exclude all others from the use of the invention (currently sixteen years in the UK).

3. Grant a licence under the patent to another.

The State enjoys the reciprocal right of publishing the patent, and the public is able to use the invention on expiry of the patent. The patent system therefore encourages the publication and dissemination of inventions whilst granting the inventor the opportunity of obtaining financial reward should he choose to exploit his invention.

The patentee can enforce his rights by suing infringers, and the successful plaintiff can secure an injunction calling for discontinuance of use and damages for infringement. The legal right to sue for infringement often confers a decisive marketing advantage.

The value of the patent as a marketing aid or as a licensable commodity varies from industry to industry. In the fertilizer industry, patenting is of less significance than in the pharmaceutical or agrochemical industries. The possibilities for a radically new fertilizer material or a completely novel process are relatively few. The majority of fertilizer patents are concerned with small changes or variants on well established fertilizer process concepts which offer limited advantage. Successful patent litigation is not usually based on the presentation of a complete anticipation of the patented invention, but rather argument that the patent is an obvious variant of what has gone before. On the other hand, the high cost involved in testing the validity of a

patent is such that even a weak patent can prove an effective deterrent when it is strongly defended.

The function of patents in the fertilizer industry is not therefore as clear cut and of decisive importance as in the pharmaceutical and other industries. However, they can serve as valuable "keep off the grass" notices to preserve a narrow area of technology for the patentee.

B. Know-how

Whilst a patent describes an invention which is recognised by a "person skilled in the art" as novel, the working and commercial implementation of the patent requires a wide range of knowledge and expertise in matters associated with the invention and the disciplines involved. Much of this material is unpatentable but nevertheless evident to the skilled engineer and marketing executive. It is this background of information - trade secrets - which constitutes "know-how".

Know-how is an essential and valuable commodity which frequently surpasses the value of a patent. It appears to be of particular importance to the fertilizer industry where the modern tendency is to spend many months in putting process plant into successful operation, and especially in maintaining successful operation once it has been achieved. Know-how is the property of the developer until such time as it is disclosed. Disclosed know-how can be freely used by other parties unless prior agreement is reached. Identical know-how can be independently developed without infringement of right. These features effectively distinguish the characteristics of the patent and know-how concepts. Clearly, the most valuable package is one in which know-how is supported by patents.

C. Data

Data is the interpretation of pilot plant operation, the preparation of heat and mass balances, equipment specifications, plant arrangement drawings, operating and analytical methods manuals, and so on. Such data need not be prepared by the licensor - an experienced engineering organisation can effectively deal with such data preparation. It can therefore fall outside the scope of a licence agreement and is bargained for on a separate basis. It is know-how - the intellectual property existing in the form of skilled people - which effectively relates data into a homogenous and commercially valuable package.

Most countries recognise and protect the right of a person or a company to invest and commercially exploit technology. In the case of patents, the rights are protected by legal statutes. Unpatented know-how however is difficult to define, with a varying interpretation from country to country. Simply, know-how is understood to be intellectual property whose content and ownership is created in the licence agreement, the practical reality of which is tested by the willingness of the licensee to pay a royalty. In the event of dispute, the laws pertaining to commercial contracts apply.

V. THE LICENCE AGREEMENT

The licence agreement formalises the commercial understanding between the licensor and the licensee. It is the legal mechanism through which the licensor confers a "right to use". For a patent licence, the "right to use" pertains to published information. The know-how licence embodies the "right to use" based on secret information. In return for the rights, the licensee undertakes the payment of a royalty or fee.

Process licence agreements should be written in easily understood langauge, preferably by a senior licensing executive with assistance from the legal and patent functions. Precedence of documents must be defined in the agreement. Letters of intent are generally undesirable, and the execution of the agreement should be completed quickly in order to avoid misunderstandings.

Many countries have regulations concerning the import of licensed technology and technical aid. Knowledge of these regulations is vital to the successful negotiation of a contract acceptable to the State, the State Bank, and other organisations. Some countries levy an import duty, it is important to ensure that this is settled by the licensee. In developing countries, hard currency export is carefully controlled. Payment for peripheral services such as plant start-up assistance, detail design work, etc., may be more conveniently included in the licence fee, so that additional ad hoc payments are avoided.

A typical process licence agreement will certainly be made up from the following "standard" clauses:

(a) Definition of the parties involved

(b) Definition of the subject process

(c) Grant of the right to build and use the process

(d) Services to be provided by the licensor

(e) Royalty and/or fee

(f) Interchange of process developments

(g) Secrecy provisions

(h) Patent indemnification

(i) Process guarantees

(j) General legal safeguards - "boiler plate" clauses - law of country under which the agreement is legally binding, arbitration, force majeure, assignability, etc..

The clauses covering the definition of the subject process and the services to be provided are perhaps the most important, and both licensor and licensee should ensure that the content is adequate and clearly understood. It is vital to the licensee that he is aware of the performance of the process with regard to such aspects as the nature and quality of any process effluents, down-time for routine maintenance and cleaning. It will be necessary to state the properties and quantities of the feedstocks, utilities, and additives, such appearing as a formal attachment to the legal document. For example, a specification for the nitric acid feedstock in terms of concentration, temperature, nitrogen oxides content and level of iron contamination is essential if satisfactory and safe working of an ammonium nitrate process is to be assured. Again, the quality of phosphate rock in terms of rock grind, level of impurities, and chloride content is important for the proper design of a phosphoric acid plant.

VI. THE COST OF TECHNOLOGY TRANSFER

The determination of process licence fees and royalties is not simple, depending much more on collective "feel" for the process, the likely value to the licensee, and the status of competing processes. It is a topic of discussion at most meetings and conferences on licensing which provokes much interest but leaves the licensor with little tangible benefit. It is a complex subject and corporate secrecy requirements

do not assist in the free interchange of experience. The frequent comment "charge as much as you can get" does the licensing business a disservice. Clearly, an essential prerequisite is the need for the licensing function to operate on a sound commercial basis with its budgeting, internal and external costs, revenues, targets, etc., fully defined. A licensing department operating under the umbrella of a manufacturing company should pay a realistic contribution for the services rendered to it by the mainstream production, engineering and marketing functions. On the other hand, an equally realistic contribution for the know-how brought into the company by the licensing department as a result of its international activity should be also acknowledged. It will also be necessary to take quantitative account of the losses of a commodity market which might stem from the sale of process know-how.

Payment for licensed processes can be made in several ways. The running royalty and lump sum fee bases are the most common. The running royalty basis requires the licensee to pay a monthly or annual fee related to a specified percentage of the value of volume of sales for a fixed period of time. In practice, a fixed fee payable on contract signature to cover the initial servicing costs plus a guaranteed minimum running royalty fee are worthwhile adjuncts to the running royalty concept. Where this system is used, the running royalty rate will generally be in the range 1-5 percent of the sale value, although the higher rate can only be negotiated for unique processes and highly profitable products. Another basis for fixing a running royalty rate is the increase in value-per-pound as the feedstocks are converted to product. In this case, a rate of around 5 percent is typical.

The lump sum method is becoming much more prevalent in the heavy chemical industry. It is preferable where the cost of preparing the know-how package is substantial and where effective marketing of the product at a high and profitable level may be difficult. The lump sum concept with only minor variants is almost universally used in the fertilizer industry. In this industry, process licensing is extremely competitive. There are several internationally based licensors for all the important processes. Licence fees are therefore sensitive to the prevailing level of business - which has been low during the past four years or so - and the need for licensors with new technology wishing to establish an adequate reference plant list. Lump sum fees for fertilizer processes generally lie in the range 5-10 percent of the battery limit plant capital investment, with only the unique processes offering considerable advantages able to command the higher fee levels.

A lump sum licence fee is normally payable in three or four instalments tied to the major stages in the development of the project from contract signature to completion of the plant or factory commissioning. Where a project requires long term credit financing backed by credit guarantees from the appropriate state or bank authorities - and this is typical of fertilizer projects in Eastern Europe - the licensee may request that the process licence fee is paid in instalments over the loan period which is frequently five to eight years. In these cases, the appropriate allowances for interest and inflation rates should be made in determining the value of the instalments.

There is now a trend for the licensee to ask for and often insist that a considerable part of the licensor's reward should be taken up in equity participation. Several developing countries make this stipulation for their fertilizer projects. Indeed, the stipulation often extends to the managing contractor and the other engineering companies which may be involved. It is felt that such participation will assure a maximum response from the licensor and his associates. There are difficulties in effecting this type of involvement and the inherent risk of subsequent nationalisation and other implications where the licensor participant has no control should be carefully evaluated.

Import duty and tax regulations can often determine the most favourable method of licence payments. A technical aid contract may be preferable to a licence agreement in certain situations.

Finally, the licensor should always be aware of the financial implications of currency devaluation.

VII. RESPONSIBILITY IN LICENSING

The licensee can reasonably expect to seek assurances for the process and services he is to invest in. He can also expect to receive compensation for any faults which prevent the process from operating satisfactorily - provided always that such faults stem from the licensor or the services provided by other companies. It is natural for the licensee to ask for formal process guarantees with respect to plant capacity, raw material efficiencies, utilities consumption and product quality. Indeed, any reputable process licensor is willing and able to give such guarantees. On the other hand, over-emphasis on guarantees usually results in the process licensor providing higher factors of safety, thus increasing the licensee's investment without any real commercial

benefit. Licensor selection on the basis of his guarantee policy alone is a poor business decision. One aspect of plant performance which sometimes appears to be over-emphasized is the efficiency of phosphoric acid processes; many licensees will attach importance to a process which offers a small fraction of one percent higher efficiency than other competing processes. In reality, the capability of the licensor and his associates in building a plant which can operate continuously with the minimum of lost time for planned and unplanned shut-downs is far more important.

Usually a process licensor will commit a considerable proportion of the licence fee to the correction of a plant and the payment of penalties. On the other hand, the licensee stands to gain a much higher financial benefit than either the licensor or contractor; this being so, the licensee must be prepared to accept most of the financial liability, including the costs of initial losses in raw materials and production. Whilst the reputable licensor realises his obligations and even exceeds them in his effort to ensure a satisfied licensee, it is important that the latter has the ability and knowledge to carry out the necessary evaluation procedures for satisfactory licensor selection and to ensure adequate transfer of all the relevant process information. The latter aspect is discussed in the next section.

VIII. THE TRANSFER OF INFORMATION

Until recently, the transfer of process technology took place by the simple means of transferring the specifications, schedules and drawings of an existing plant with a proven commercial performance. Process guarantees were not called for since essentially a duplication took place.

With the advent of a rapidly changing technological environment and the growing transfer of technology on an international scale, such practice is no longer acceptable. Plants based on licensed processes are rarely identical to those operated by the licensor. It is necessary therefore that the transfer of technology should take place in an organised manner. The process licensor is required to assess the information and data and create a process design package based on the optimum criteria for each new plant. It is not really good practice or indeed effective for a process licensor to merely provide a collection of information, data, typical drawings, patents, etc., to the process engineering company or the licensee for resolution into a physical reality.

There are two well established routes to the transfer of a process licence and the associated technology from the licensor to a licensee. The first route, often used for

the lower capital investment projects, is based on a direct link between licensor and the licensee, leaving the latter to make independent arrangements with his own organisation or a process engineering company of his own choice for the detailed engineering, procurement and erection services. The second and more important route, frequently used for major projects, is based on the transfer of the licence and technology through the process engineering company responsible for the overall engineering services. In this way the licensee is dealing essentially with only one party, so that risk of misunderstanding and inadequate collaboration which is likely with the tripartite concept of the first route is minimised. Although the second route implies that the process engineering company carries the legal responsibility for process guarantees which are properly the onus of the licensor, it is well suited to the modern concept of a licensor having formal and long term general collaboration arrangements with a few international engineering contractors who are therefore well experienced in the technology and with whom worthwile working relationships can be developed.

To organise and prepare a process package in a set period of time, the process licensor has to be able to call upon the services of an experienced project manager who in turn has the authority to claim the services of specialist engineers on a priority basis. It is of considerable importance that the process engineering company or the licensee can be in a position to identify by means of curriculae vitae and personal contact the key personnel in the process licensor's organisation. Although know-how is spread through an organisation, it does reside in people, the loss of key staff through promotion and transfer to other sectors can have serious consequences to the capability of a process licensor to discharge his responsibilities in an effective manner.