

# Chemistry and the Transfer of Technology

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Industrial development has become increasingly important to the economy of Sri Lanka over the last few decades. Chemistry is used in almost every facet of industry ranging from the extraction and utilisation of heavy metals to such diverse industries as foods, polymers, synthetic fibres, drugs and microelectronics. As a result, chemists and those trained in related disciplines such as chemical engineers, food technologists and biochemists are employed in nearly every industrial organisation.

A considerable number of highly skilled persons graduate in chemistry from the universities in Sri Lanka and it is relevant to examine the programmes available for the effective utilisation of this national resource of knowledge and information. A prerequisite to the effective utilisation of the available know-how is an inflow of information on available technology and related industrial information, a process that can be broadly classified as one aspect of technology transfer.

The discussion will be relevant if ongoing industries and projects are used as a guide to understanding how much technological knowledge has been accumulated in the country over the many years of industrial progress that has gone on in Sri Lanka. Such an analysis will further be helpful in considering methods by which the net inflow of technology can be increased.

## Classes of industry using Chemistry

The chemistry based industries in Sri Lanka can be very broadly divided into the categories of private and public sector enterprises and the following subdivisions may be recognised within each category.

- (a) Heavy industry eg. steel, tyres, petroleum processing;
- (b) Light industry, eg. batteries, toilet preparations;
- (c) Food process industry - jams, cordials, soft drinks;
- (d) Cottage industry - handlooms, handicraft.

It is quite evident that chemical knowledge is certainly applied at some stage in (a), (b) and (c).

The heavy industry in the country is almost entirely state owned and the required technology has been obtained generally by intergovernmental agreements. This type of technology acquisition represents the extreme case where packaged complete process technology has been purchased or obtained by long-term financial agreement. The role of chemists in this type of industry is mainly in quality control

work governed by standards laid down in the original process and related to product standardisation.

The fast growing facet of industry in Sri Lanka is however, mainly in the class of light industry and food processing industry and it is of interest to briefly consider the usefulness of chemical knowledge in this area and to also discuss means by which the national store of knowledge can be increased; an important aspect of effective technology transfer.

## Modes of Technology transfer

The setting up of any manufacturing industry will require information on the best process technology available as well as information on the type of equipment to be utilised. This is, of course, in addition to the investment of capital and market prospects for the product. The framework available for the acquisition of technological knowledge can be classified as:

- (a) The setting up of subsidiaries of international organisations;
- (b) The manufacture of branded products under franchise agreement;
- (c) Setting up of joint ventures;
- (d) The development of technology through research and development.

The setting up of subsidiary companies or the manufacture of branded products under franchise agreement is the type of industry that can be set up most conveniently, but the long-term usefulness of such enterprises is questionable. Generally, such industries come into the country with well established processes and all research and innovative changes are effected in the laboratories of the principals and only the results are transmitted. The national personnel are employed to keep the quality standards and may not even have the full details of processes. In a sense, their jobs are routine and the sum total gain of technological know-how is limited.

Joint ventures, on the other hand offer a greater promise. Many joint ventures are in operation in Sri Lanka at present, mainly in the Free Trade Zone. Most of these ventures are located in the country to take advantage of cheap labour and special concessions but some positive technological gain can be ensured by carefully planning such joint ventures. An important consideration should be training of local

personnel. If the agreement can incorporate some element of training particularly in the process plants of the principals, a useful step can be considered accomplished. Joint ventures in chemistry based industries are not common in Sri Lanka but could be very useful in areas such as polymers (including manufacture of synthetic textiles), food processing and canning and beverage manufacture. The advances in these fields are very far reaching and it is certainly in the interest of the country to have some access to this technology.

The most complex category for a developing country and yet most important is the evolution of an industry through Research and Development from the basic beginnings. The final results can be very beneficial but in the case of chemistry based industry, in particular, the cost of research and development can be so high that an organisation with high R & D expenditure may not be able to recover these costs from its own operations. Yet, Sri Lanka produces its own pool of young chemists and chemical engineers and we also have a number of raw materials. An important question is how the globally available knowledge can be transferred effectively to the country to be utilised in the setting up of industries based on our own raw materials.

The State Sector in Sri Lanka is perhaps the main source of new processes and products. Engineering or light industry related processes have originated from the Ceylon Institute for Scientific and Industrial Research and the National Engineering Research and Development Centre. More chemically based processes have been formulated by the CJSIR and also the Crop Research Institutes for tea (TRI) rubber (RRI) and coconut (CRI).

#### Development of Processes

A large number of processes have been patented by research organisations in Sri Lanka and sometimes even developed up to the largescale laboratory or pilot plant stage. Licencing of patents for chemical processes or food and beverage production processes has been very slow to take effect in Sri Lanka. Investors are generally interested in ventures which promise a rapid and sure return of capital. They will not normally want to tie up capital in R & D even if the final product has a promise of a good market.

Thus, it is of interest to consider the alternatives available in commercially exploiting chemistry based processes developed in Sri Lankan laboratories.

The possible alternatives are:

1. The formation of a joint venture with a private sector organisation with or without foreign collaboration is the first alternative. In this case, all the process know-how or at least most of it, will generally originate from the laboratory that has formulated a process. Information on equipment designs and their adaptation will originate through the purchase of machinery, particularly if the equipment manufacturers are requested to provide a turnkey process.

2. The second alternative is for the originator of the process to go a step further and scale up the process to a point where economic evaluation and costing can be carried out and samples provided for market tests. The principal question here is the manner in which technology can be acquired at moderate costs.

Technological information is available through organisations such as UNIDO for some of the processes. In other cases the main process know-how has to be developed indigenously.

In the context of the discussion so far, it is relevant to note that the technology developed must also be relevant to the country. The principal consideration being whether the plant or process line developed can be maintained and run with locally available resources and manpower.

Trained personnel are certainly available in the country but chemical technology is nearly always owned by large companies abroad. Such organisations will not give away know-how without assurance of some return, mainly because they would have already invested in R & D to build up their knowledge.

In overview, developing countries have to build up their own technological information banks and continued research toward new processes and scaling up of such processes is absolutely necessary, in spite of the high cost.

Co-operation between lesser developed countries including technology exchange programmes can be a mutually useful route in addition to each one developing its own technology. The development of commercially exploitable processes need not always be considered as the only successful end of a project. It is well to bear in mind that spin-off benefits from the net contribution to knowledge should also be considered important to any developing economy.