THERE WILL BE A VERY STRONG INTERFACE OF BIOLOGY AND CHEMISTRY'

National Chemical Laboratory (NCL), Pune, was established in 1950 as a constituent laboratory of the Council of Scientific and Industrial Research. A science and knowledge-based research, development and consulting organisation, NCL is internationally known for its excellence in scientific research in chemical and life sciences as well as engineering. NCL has an outstanding track record of industrial research involving partnership with industry from concept to commercialisation. Its mission is to deliver a product, process, intellectual property, tacit knowledge or service that can create wealth for NCL's stakeholders, offer scientific understanding-based high quality solutions to the customers, and create and sustain specialised resource centres as platforms to grow future areas of skills and competencies. Dr S Sivaram, Director, NCL, shares his views on its role in technology development in India and foresees the future of global chemical industry in an interview with Martin Menachery. Excerpts:

What is the role of institutions like NCL in helping the technology development in India?

To answer this, I would segment the technologies in terms of industry sectors. First of all, there are very large industries with investments of thousands of crores of rupees. Then comes mid-segment industries with about Rs 500-1,000 crores capital base. The lower end of the mid-segment is Rs 100 to 500 crores. And finally, tiny segment which is worth as low as Rs 5-100 crores. When talking about solutions to problems facing the chemical industry, we need to look broadly at all these three or four segments.

In the very large segment of the industry with a mature technology base, a laboratory like NCL can act only as a catalyst for improvements by enhancing the marketability of products, optimising process efficiencies, and help in developing new products and reducing the overall cost of manufacturing. We cannot implement such technologies from concept to commercialisation because the technologies are mature and many of them are available for licensing with license fee as low as 2-3 per cent of the total capital cost. There are no incentives for us to develop such technologies. For large companies, command over the market is of paramount importance. If they do not have command over the markets, they will not exist, and so they need to produce and enter the market very quickly. They cannot wait for five to ten years for the technologies to be developed and attain maturity. If the technologies are readily available at reasonable licensing costs, they should go for it because only then they can enter the market faster. So, for the large industries, NCL's role would be basically to effect incremental improvements and evolutionary developments in the technologies they operate. Also, the nature of the markets is uniquely different here from those in the other parts of the world. The cost structure in our country is also very unique. While a customer abroad may be willing to pay a given price for a product, his Indian counterpart may not be willing to do so, and in that case, the need is to rework the same product technology in India and make it acceptable to the local markets both in terms of cost and performance. For the really lower end of the investment segment, NCL has opportunities in technology development. Opportunities are there for two or three reasons. Small companies are interested in product or process technology, which is small in volume, high in value and with low capital investment. Of course, in today's context, small volume manufacturing must be globally competitive in terms of economics. That is a challenge for us because we must make a small volume plant very efficient. Generally, there is a nexus between volume and cost, with costs going down with increasing capacity. We need to break this nexus by clever process engineering.

Sometimes we may have to compete with a manufacturer elsewhere who is producing the same product on a large volume. NCL sees opportunities there. There are a lot of fine chemicals for which vendors are limited to one or two in the world, and they, therefore, determine the prices. At NCL, we are trying to identify such products that are of low volume and without many global producers. When there are more than two or three vendors, we have to look at the project

very carefully because of the impact of competition on the price.

When there are only one or two vendors, is it necessary that the manufacturing has to be only in the large scale?

Not necessarily. It might be a speciality chemical, which is not a large volume chemical. We may talk about a few thousand tonnes - may be even 5,000-10,000 tonnes globally. We have examples of several such products in the pipeline and some of them we have developed recently. These are the kinds of products we are identifying. Where there are limited vendors, there is an additional advantage of good export markets. We also make sure that the chemicals have domestic markets. We are doing a complete scanning - identifying the technologies behind all these very limited-vendor items and whether they are in patent or out of patent. Obviously, the ones that are out of patent are better because the export markets are easier to capture.

We are laying down multiple parameters to judge such chemicals - we are looking at the cost and availability of raw materials in India because one cannot be competitive if one has to import a raw material and export the finished product. Some of these are additives, which go in polymers and other applications. For example, to make transparent polypropylene, clarity is needed. Normally, polypropylene is not clear, but additives help improve the clarity. Such additives are available from only one or two companies in the world, who market it at exorbitant prices. In India, market for such products would not grow at this price as it adds to the cost of the polypropylene. Now with a clarifying agent - either the same one at a lower cost or an alternative one with certain advantages at a lower price - we can open up segments of new market opportunity for polypropylene.

Are you basically looking at providing the know-how for this?

We are currently working on such products. If we succeed, then there will be opportunities for manufacturing. Today, as you are aware, all transparent containers are made of PET, which is about twice the cost of polypropylene. So, improving the clarity will open up new markets for polypropylene. But clarifying polypropylene at acceptable cost calls for significant technology inputs.

In a country like India, where the government and private institutions are seen in different frameworks, what is the market penetration you are able to make?

As I said before, for larger companies, our services and solutions are in terms of incremental advances and improvements. This has no bearing on volume. Plenty of opportunities are there for improvements in catalytic processes. Here, the investments involved are not heavy at all since other than the new catalyst, there is no change in order to improve the efficiency.

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Here, we can bring changes in reaction parameters based on a better understanding of the dynamics of the reactions. We have abilities to model and simulate the kinetics and tune the reactors for optimum performance. Therefore, we can contribute to enhanced productivity and add value to the company.

Your comments on enhancing process efficiency...

When we talk about evolutionary changes in technology or incremental advances, it is difficult to speak of absolute efficiency improvement except understanding it through the perception of the people who run the plant. This is because you have not changed the fundamentals of technology, but only perturbed it. We can, therefore, set only qualitative indicators. But when it comes to the grass-root developments of technology, then one can set quantitative indicators - in terms of how much a company is producing, selling and exporting.

Very often, in many large chemical operations, several improvements are being done together. So, segmentation becomes very difficult. For example, using some very advanced chemical engineering principles called artificial neural network, some of my colleagues in the chemical engineering division have developed strategies for process control of a large plant. This strategy is in operation in one of the plants of Reliance Petrochemicals at Hazira. They have superimposed the more advanced control systems on the existing one. This has resulted in more steady plant operations and less product quality variations. NCL has substantial knowledge base in such advanced process control systems, which can improve process efficiencies of both batch and large continuous plants.

What is the acceptance level of indigenously developed solutions for chemical process industry in India?

In general, I find the demand for R&D-based solutions to be relatively low in the Indian chemical industry. The basic reason for this is that for the last 20-30 years, the companies have looked at markets and technologies in a very limited manner. It is not limited in terms of funds but in terms of activities and reach. Secondly, investments in research pay back in time. Quick recovery is not possible, especially in the chemical process industry.

Any time you develop new products, you need to penetrate not only domestic market, but also global. We have witnessed many Indian companies, which do not explore global markets. But, after the acquisition by foreign companies, their products grow in the reach and acceptance. Those overseas companies are aware of the significance of marketing reach that many Indian companies are not aware of. Right now, some of the large Indian chemical and pharmaceutical companies are aggressively looking at the global markets.

Can we say that our government and its scientific agencies should play a proactive role in terms of commercialisation of technology - its researchandmarketing?


Molecular modelling facility at NCL.

Scientific departments cannot do this. Scientific departments can only act as think tanks - as idea providers and idea demonstrators.

Can we say that the quality of research that is happening in India is world-class?

I would not say it is uniformly world-class. But, yes, in many specific areas, it is definitely world-class. We do have islands of excellence, which are world-class.

Can you be specific about those areas?

I think in the area of fine chemicals, we are world-class in terms of our ability to do good research. In fact, the success of the pharmaceutical industry today confirms this. India has a tremendous opportunity in terms of developing either new molecules or new intermediates for existing molecules at a lower cost. One of the advantages India has had in the past was the patent regime. The drug companies with patent regimes have monopoly markets, so they have no incentive to reduce prices. In many of the molecules that are going out of patent in 2007, there is tremendous opportunity for cost reduction in organic chemical processes, especially in batch manufacturing, an area that has received scant attention. With competition all set to escalate, there would be many innovations pushing the prices down. This is where a commodity industry like plastics had a completely different way of growth - there was always tough competition and as a result, prices of materials came down with time. In some other areas like drugs, real prices of materials have gone up with time because of the monopoly. This monopoly will go away in 2007 for many of the drugs and, so, there will be a tremendous opportunity for the Indian companies to innovate, bring costs down and relentlessly drive process efficiencies upwards. This will require significant innovations in process chemistry and engineering.

What is your opinion on the scope of our chemical industry in the global vis-a-vis domestic markets?

I think any player in the chemical industry today will have to look at the global market. But I also believe that if you do not have at least 50 per cent footprint in your own domestic market, you cannot reach the global market. This is because the domestic market is the one that gives you the sustenance to develop and improve products. I believe that for fine chemicals, it could be 30-40 per cent domestic market and 60-70 per cent overseas market, while for commodities, it could be 70-80 per cent domestic market and 20-30 per cent export market. If a company does not command marketplace in India, it cannot have a global market.

Enhancing sustainability in terms of processes and products will be another focus area and this will determine the future strategies of growth of the chemical industry. So, there will be a redesign of materials to address the issue of sustainability. I think that this is the right way because if the chemical industry, which is at the crossroads today, does not become sustainable in the next 25 years, its very existence will be threatened.

Chemical process industry is the oldest knowledge-based industry. It is there for the last 150 years or so. It has an important position in everybody's life. What could be the future of the global chemical industry in terms of the value added to human life?

I think the global chemical industry will continuously transform itself. There are two or three themes around which you will see the changes. First of all, the global chemical industry will be more material-focussed in the sense that it would not just produce raw materials, but it would increasingly be more focussed towards end-applications and end-products. Enhancing sustainability in terms of processes and products will be another focus area and this will determine the future strategies of growth of the chemical industry. So, there will be a redesign of materials to address the issue of sustainability. I think that this is the right way because if the chemical industry, which is at the crossroads today, does not become sustainable in the next 25 years, its very existence will be threatened. Again, in many areas - right from materials to chemicals - there will be a very strong interface of biology and chemistry. It is recognised that sustainability is related to biological processes because we all know from our life that nature is very sustainable. I think that is going to be a very important theme and there will be technological changes - platform changes that will occur in raw materials and application changes that will occur from the sustainability point of view. Most importantly, there will be a relentless drive towards improving efficiencies at all levels - energy, raw materials and effluents. Some of this will be, of course, driven by legislative compulsions.

Again, inventory management of chemical plants will become extremely important in the future. People will like to know where every milligram quantity of the input material has gone. Auditing will be throughout the life cycle of the products and not just in the manufacturing process. The producer will have the onus of providing such an audit to the consumer. This move will drive the industry to set new benchmarks of performance. These are the major innovations expected in the global chemical industry in the near future.