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TECHNOLOGY TRANSFER

An Indian Experience of Technology Acquisition in Cement

A.K. Chatterjee
The Associated Cement Cos. Ltd., Research and Consultancy Directorate, Thane, India

Background of Technology Acquisition

The Indian cement industry, which is over eight decades old, saw an interesting resurgence in the 1980s. This resurgence was caused by the Indian Government's adoption of deregulation policies first in 1982 with partial decontrol and then in 1989 with total decontrol of cement pricing and distribution. The resultant effect was phenomenal and dramatic in creating new capacity. As a net result, today the industry has the distinction of being the fifth largest producer of cement in the world with almost 77 million tonnes of annual installed capacity.

The present story of technology acquisition relates to the same decade of the 1980s. In the early part of the decade, our company, like many others, was encountering serious problems in managing old, small, and loss-making wet process plants, which, due to protective policies of the Government, were not disposable and the conversion of these plants to dry process technology was not economically viable. Under those circumstances, the newly developed alinite cement technology (alternatively known as low temperature silicate technology) in what was then the Soviet Union appeared to be an attractive solution as it did not involve any major change in the basic process, thereby making the conversion less expensive. Further, the process seemed to have the potential of yielding substantial benefits in terms of kiln output, energy consumption, specific consumption of raw materials, and so forth. Following a series of visits and discussions with the Soviet agency and the concerned research institute during 1983–85, our company signed an agreement with the Soviet agency for transfer of this know-how to our company. Thereafter, the implementation of the technology was taken up in earnest. Despite sincere intentions of both the parties, the technology transfer agreement had to be abandoned in 1988 due to a number of technical and engineering problems and changes in the domestic environment.

In retrospect, this case study turned out to be an interesting revelation of certain critical aspects of technology transfer particularly in the field of cement. Some of these aspects are dealt with in the following sections of this article.

Techno-Scientific Ambiguities in Technology Transfer and Technology Evaluation

As already mentioned, the preagreement technology evaluation period in this specific instance was quite an extended one. This kind of prolonged assessment was necessitated by the following factors:

1. When the dialogue was initiated for technology transfer toward the end of 1983, the technology had just moved from pilot plant to an experimental wet process kiln of about 200 TPD capacity. The proving of technology and upscaling of technology were being dealt with almost simultaneously, and this often created a sense of uncertainty in the minds of the technology assessment team members about the likely realization of the promised economic performance of the technology even for similar small wet process plants. Consequently, the claims of the technology developers for easy and successful adoption of the technology for upscaled and dry process plants could not be taken for granted.
2. The limited run of the experimental facility and the preceding pilot plants created doubts about the chloride corrosion of certain sections of plant and machinery after continuous and prolonged operation for which no conclusive answers could be obtained from the technology developers.
3. While evaluating the technology in detail, the technology assessors realized that the chloride

Address correspondence to: A.K. Chatterjee, The Associated Cement Cos. Ltd., Research and Consultancy Directorate, L.B.S. Marg, Thane, 400 604, India.

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content in the finished product would lead to problems of acceptability of the cement in the market and problems in obtaining the approval of India's statutory authorities for the cement's unrestricted use. Hence, we had to carefully evaluate the products for which this technology could be acceptably adopted without any apprehension of durability.

Of these three critical issues, it was easier to find answers to the first two problems than for the third one. But because the product was cement, the third issue had an overriding priority in the decision-making process.

To resolve the major technological issues before signing the agreement, our company organized a more-than-usual assessment of the status and potential of the technology with the help of a multidisciplinary team composed of experts from research and development, operations, design, marketing, and concrete technology. At the technology evaluation stage, we had to take care to maintain a delicate balance between scientific probing and the organizational relationship between the technology supplier and ourselves. This balance became more crucial when the technology supplier selected our company for the technology transfer; the supplier recognized our technological base of research and development, design engineering capability, operational expertise, and so forth, which, they apparently summarized, would make up for the shortfalls in their technology development. However, we had to critically weigh the completeness and practicability of technology transfer against the price of technology.

Notwithstanding the above dichotomy, we undertook an elaborate technology assessment program, including laboratory experiments on chloride corrosion in process and product. Because long-term reinforcement corrosion data could not be generated within our schedule, we performed a worldwide expert opinion survey on specific techno-scientific issues.

Based on all these inputs from internal and external sources, we decided to go ahead with the acquisition of this technology but to restrict its implementation to the manufacture of non-load-bearing binders like white, decorative, and special cements.

Thus, the equivocality of the technology and the lack of convincing demonstrability got in the way of easy transfer.

Communication and Documentation

The relevance of communication and documentation in technology transfer cannot be overemphasized. It is well known that communication between the technology supplier and receiver involves both passive and active links. Passive links are usually media-based and have a broad sweep. Research papers, journal articles, oral presentations by acknowledged experts, video tapes, and so forth, are generally classified in the passive category. In the present case of technology transfer, this part of the passive communication turned out to be quite effective despite the language barrier. Because these passive communications were more on fundamental scientific issues and nonspecific broad technological potentials, they were reasonably impressive and acceptable.

Active links are direct expert-to-expert interaction. They may range from teleconferences to team interactions and on-site demonstrations. Generally, active links are established after passive communications are understood and after know-how and do-how documentations are received for technology implementation.

In the present story of technology transfer, the quality and adequacy of documentation containing know-how and implementation schemes were far inferior to the media-based passive communications mentioned earlier. It should be mentioned that because this technology implementation was planned in the existing operating plants, the know-how transfer and implementation schemes had to be worked out by the technology supplier on the basis of actual plant studies and after establishing the techno-economic parameters of retrofitting the new process features to the existing plants. The documents prepared by the technology supplier based on the above considerations, when examined in detail, were found to have the following shortcomings:

1. Because the documents were the English translations of the originally prepared Russian versions, there were numerous distortions in expressions that could not be easily deciphered.
2. There were a number of plant-specific engineering issues that were missed in the documentation. This could be due to language problems; the experts of the technology supplier during their plant visits could not comprehend and assimilate the requirements of the technology receiving side.
3. Quite a few technological features as presented in the technical documentation differed from what were demonstrated or explained to the engineers of the technology receiver during their visit to the pilot and experimental plants of the technology supplier. The basis for such engineering modifications and their impacts on the economic performance of the technology could not

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be substantiated by the technology supplier as these changes were not fully proven in operation.

Following the receipt of these documents there was a demand for active communication through person-to-person interactions. These could not be organized to the extent desired. The geographical distance, language barrier, and cultural separation came in the way of making face-to-face communication effective and comprehensible.

Managerial Role and Motivation

The technology receiving company attempted to produce a new product from an existing plant with marginal modification of plant and machinery. Because the technology was new and not adequately proven, the research and development set-up of the receiving company saw a scientific and technological challenge in the adoption of this technology and, therefore, wanted it to be implemented in the concerned plants. Because of the process novelty, scanty data of plant operation, and uncertainties about the time that would be required for process stabilization, the operational engineers were not as enthusiastic about implementing the technology as the research and development scientists and engineers were. Because the product was radically different in composition and because worldwide apprehensions were known to exist regarding the acceptability of the product, the marketing staff were not confident of selling the product in a competitive market despite the decision of the company to restrict the technology to the sphere of products in which the so-called deficiency of composition and property would not matter. The design engineers had apprehensions in certain engineering features of the project that they felt could bring down the availability of the plant. Thus, one can observe that within the receiving organization, the motivation for adoption and implementation of the technology was widely variable. Consequently, the efforts put into this technology transfer by different groups were of varying magnitude. The top management of the organization attempted to circumvent the difficulties emanating from conflicting motives of different groups by creating a multidisciplinary task force placed directly under the charge of the director of operations. Notwithstanding, the problems of communication and insufficient documentation aggravated the situation and slowed down the pace of technology implementation.

Environmental Changes

It has already been mentioned that the novel technology from what was then the Soviet Union was looked at by the receiving company under the compulsions of the industrial and economic environments prevailing in the country. This was also the time of transition—transition from control to decontrol, from regulation to deregulation, from seller's to buyer's market. During the time of prolonged implementation of the technologies, the opportunities to dispose of loss-making units presented themselves. Better technologies became available for conversion of smaller wet process plants in a viable sense. The market turned out to be more competitive in terms of quality and the Bureau of Standards in India became more conscious and introduced clauses in the standard specifications restricting the use of chlorides in cement. Thus, the scenario of the cement industry in India underwent a dramatic change. In this changed scenario, the technology that had been in the process of transfer for almost 5 years from 1983 to 1988 had to be abandoned.

Conclusive Lessons

Although technology transfer is variously defined by authorities, it can broadly be understood as a geographical shift of a technology from where it is developed to where it is going to be used. Conceptually it has to be treated as the application of knowledge.

There are a few fundamental aspects to the transfer process. First, the technology must be invented and techno-economically proven before transfer. Second, the transfer mechanism should be comprehensible and transparent through passive and active communications, documentation media, proving runs, and so forth. Third, a technology must be expeditiously transferred to and used by the appropriate receiver.

Elaborating further on the above points, one may reiterate that a technology that is low in equivocality is easy to transfer and receive. The higher the equivocality of the technology, the more difficult it is to educate prospective users on the value and applications of the technology.

To effect technology transfer there needs to be ability, desire, and time to communicate across organizational boundaries. The fewer and more passive the communication links, the less likely are the chances that technology will be successfully transferred.

The geographical distance, cultural difference, and language barrier do affect the technology transfer, sometimes in a very significant manner. The ultimate requirement is the unison of frequency of understanding or unanimity of views between the technology supplier and technology receiver. The chances of success rise as the mutual trust grows.

The technology transfer in the field of cement mostly involves multidisciplinary effort. The motivation for

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participating in a technology transfer and implementation exercise could vary from group to group and from specialists to specialists in an organizational set-up, and such varying motivations often pose a managerial challenge to the successful transfer of technology. It is often said that the organizational performance in general and technology transfer in particular depends on the success of integrating and managing five Ps—product, process, people, procedures, and performance. In this effective integration of five Ps, there is a poisonous sixth P, that is, procrastination. Procrastination should be avoided under all circumstances through adoption of speed and timeliness in all technology transactions, because competing technological developments and continuously changing socioeconomic environments influence the technology transfer more than anything else.

The aforementioned lessons could be effectively learned from the experience of the technology acquisition narrated in this article, and they paved the way for a more careful approach towards technology transfer in our organization.