Absorption and diffusion of imported technology

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Contents

Foreword 5
Introduction 7
ADIT: A Review 13

Case Studies

Accumulation of technological capability and assimilation of imported industrial production systems in the cotton textile industry in Bangladesh
Quazi H. Ahmed 21

Absorption and diffusion of imported technology: a case study of four industries in Sri Lanka
Marga Institute 28

Some issues pertaining to technical change in the cotton textile sector in Sri Lanka
W.D. Lakshman 37

Absorption, assimilation, and diffusion of imported technology in Pakistan: a case study of the textile and pharmaceutical industries
Firasat Ali and Jamal Ahad Khan 41

Technological change, transfer, and diffusion in the textile industry in India
Amitav Rath 49

Technology and market structure under government regulation: a case study of the Indian textile industry
Ashok V. Desai 61

The Philippine ADIT project: a summary paper
Luke Kho and Lope Cuaresma 73

Absorption and diffusion of imported technology: a case study in the Republic of Korea
Woo Hee Park 79

Analysis of systems behaviour in the absorption and diffusion of imported technology
Suck-chul Yoon 90

Comparative Studies

Similarities and differences: the Indonesian case
Nilyardi Kahar 95
Japanese investments in South Asia from a global perspective
W.D. Lakshman 97

Comparative analysis of technology policies of ADIT network countries
Quazi H. Ahmed 105

Workshop Conclusions 109
Participants 112
Some Issues Pertaining to Technical Change in the Cotton Textile Sector in Sri Lanka

W.D. Lakshman

Technological change, without doubt, is a major factor in the economic development of a country. This has been established in studies about the reasons for growth in advanced countries. This paper constitutes a summary statement of some conclusions from a larger study in which an attempt was made to examine technological change within a selected industry in Sri Lanka. Some of the questions that influenced the direction the study followed are: (1) What are the indicators of technical change pertaining to a given industry? (2) What are the processes through which technical change takes place in an industry? (3) How does such technical change influence growth in the industry concerned and in the economy as a whole?

The study concerned itself with the cotton textile industry in Sri Lanka because of its important position within the country's economy. Moreover, given the relatively long period of time during which the manufacturing of cotton textiles has been practiced in Sri Lanka and the relatively simple nature of textile technology, the cotton textile sector was thought to be a good choice of industry for a case study of technological development.

The cotton industry in Sri Lanka has a number of dimensions. There is the large-scale mill sector as well as the small-scale sector operating handlooms and powerlooms. It is only in weaving that one finds this distinction because spinning and finishing processes are, by and large, found exclusively within the mills sector. Some of the mills are integrated in the sense that they are designed to handle more than one relevant manufacturing process, whereas others are not integrated. The cotton industry, in addition, has a public sector, cooperative sector, and private sector.

The detailed case study that was carried out excluded the small-scale sector from its scope because of the immense data-gathering problems that were anticipated in a study covering that sector. Again, due to the ease of collecting data, the study concentrates on only five of the public sector mills within the large-scale mill sector. In terms of production, although probably not as much in terms of employment, the mills covered form a large proportion of the country's cotton textile industry. Differences in the patterns of technological change are bound to exist between the mills covered in the study and the rest of the cotton sector in Sri Lanka. Most of the major trends, patterns, and problems pertaining to technological development in the country's cotton sector, however, are expected to be highlighted in a study of public-sector textile mills.

The more detailed study is prefaced by an examination of the country's environment on the grounds that the direction, nature, and extent of technological development within a given industry are influenced by the overall environment. Social conditions in Sri Lanka are a reflection of, as well as a causal factor behind, the low level of industrialization. The nature of capitalism introduced by the plantation investments of the 19th and early 20th centuries was not conducive to promoting an industrial capitalist class. High rates of unemployment and underemployment, resulting from low rates of economic growth, produced a low-wage economy. The working classes lacked industrial skills and discipline. The predominantly rural character of society has been another factor adversely affecting industrialization, but high rates of literacy among the labour force probably provided conditions conducive to easy on-the-job acquisition of industrial skills by the working people.

The overall economic conditions within the country since the 1950s were characterized,
generally, by low rates of growth. In terms of the gross national product (GNP) and employment, the agricultural and service sectors have come to dominate the economic structure. The structure of the foreign trade sector has come to show its inherent weaknesses from the late 1950s in the form of consistent deficits in the balance of payments. Government commercial policy from that time up to 1977 was dictated by these payment difficulties and during this period imports and exchange payments came to be the subject of extensive controls. This “control regime” provided the basis for a process of import-substitution industrialization, with all the problems that attended such industrialization in other underdeveloped countries.

The political system operated through a multiparty setup within which there was a polarization into two main groups. The powers of government changed hands between these two groups on several occasions. Resource allocation mechanisms within the country have come to depend heavily on a political choice mechanism within which the political supporters of governments in power have become powerful agents. The two main political groups have had differences of positions with respect to international power groupings even though both explicitly professed themselves to be nonaligned. In the industry and technology field this has had certain implications, e.g., during the regimes of one of these groups, countries of the socialist block have been important technology suppliers to the country.

One discussion in the main study, of the overall environmental conditions, is followed by an overview of the textile industry in Sri Lanka. Having traced the historical trends up to the late 1950s, a detailed examination of government policy and the development of the domestic textile industry since that time has been attempted. Growth of domestic production and some of the attendant problems have also been discussed. The composition and relative size of the industry and the institutional structure that had a bearing on the industry have been examined as well.

Market conditions, both product and input markets, determine the nature of technological developments within any industrial field. Product market size has been roughly ascertained in the study to show that up to 1959, availability of textiles was adequate to meet market requirements but not generally so after that date. The product market was sufficiently large to sustain a growing textile industry in the country, particularly in the cotton field. The potential market that existed even prior to 1959, however, became an effective market only after protective measures taken since that time. The product market conditions dictated the following technological needs: (1) import controls on cotton textiles and their essential nature in consumption patterns made adoption of technologies necessary that could ensure quick expansion of domestic production and (2) the quality composition of the market made the handloom sector a poor source to meet market demand.

Thus, from the point of view of product market characteristics, acquisition of mill technology into the cotton sector was needed. Given the country’s factor endowments, handloom technology was, perhaps, more appropriate. The compromise policymakers seem to have sought here is indicated by their consistent attempts to simultaneously promote the mill sector as well as the handloom sector of the cotton industry within Sri Lanka.

Although domestic production of cotton textiles grew in response to product market needs, the industry remained heavily dependent upon imports to obtain its needed inputs. This was particularly evident in the case of raw cotton. Domestic supply of raw cotton remains, even today, a very low proportion of what domestic industry can use, in spite of relatively rapid expansion of raw cotton production during the recent past — a rapid expansion because of the very low base from which local production started. Policy in manufacturing and agriculture in this respect was uncoordinated. One is tempted to question the adequacy and advisability of the strategy of depending upon small farmers to promote cotton cultivation.

Labour market conditions affecting the growth of the cotton industry have also been reviewed. The annual output from the educational system and the drain of skilled personnel from the country have been considered in relation to the needs of the industry for technically competent personnel.

Scarcity of foreign exchange and capital has been a serious constraint on the growth of the domestic textile industry. Often, technological choices were dictated by such extraneous factors as the availability of foreign resources rather than by valid economic considerations. This is clearly shown in the choice and transfer of technology into the public sector of the cotton industry. Of the five public sector mills studied, four are equipped with technology obtained from two socialist countries — the German Democratic Republic (East Germany) and the People’s Republic of China. The choice of machinery,
equipment, and know-how from these sources was hardly the result of a free choice. The government, wanting to expand textile manufacturing capacity, was not in a position to shop around for the needed machinery and equipment due to a lack of the necessary exchange resources. When project aid was made available by these two countries, the mills provided under this aid were accepted with no inquiry into the appropriateness and efficiency of the machinery and equipment involved.

The technological capability of the domestic cotton textile industry depends upon the degree of its absorption and diffusion, which, in turn, are influenced by overall environmental conditions, market conditions, and the nature of technology transfer. An attempt has been made to measure the degree of absorption of imported technology on the basis of existing levels of knowledge, experience, and confidence of top technical staff of five public sector mills under the National Textile Corporation (NTC). On the basis of a point scale, with a possible maximum of 100, the degree of overall absorption of technology has been measured at 34%, a rather low level given the length of time the country has been manufacturing cotton textiles. A lot of valuable information is, of course, hidden behind this overall figure. People seem to be more capable in process technology than in engineering technology and related research and development work. They seem to be more capable in weaving and spinning techniques than in finishing. The degree of absorption of technology is also seen to be varying in the different subareas under spinning, weaving, and processing.

The measure of technology diffusion used is the proportion of the market requirements of the cotton textile industry actually satisfied by the products of the mill sector. Although the machinery and equipment used in these mills are far from being uniform, the mill sector and decentralized powerloom sector are taken here as representing one particular type of technology distinct from the handloom technology adopted in the rest of the cotton sector. It is, of course, only weaving which is taken into account in this measure of diffusion. Starting with a very low degree, diffusion of imported textile technology spread to reach an average of 36% between 1973 and 1976. It was found that protective measures were also important in promoting diffusion of imported textile technologies.

The degree of assimilation of imported textile technology into the local environment, defined as the degree of self-sufficiency of the country in the input requirements of the local textile industry, has been poor. Spare parts, accessories, and chemicals required by the industry, estimated at approximately Rs105 million (U.S.$5.85 million) per annum, are mostly imported. Dependence of the industry upon imports for its raw cotton requirements has already been noted. In the past, expatriates have worked within the domestic industry, but today, except for those working on the installation of the finishing sector of one of the mills studied, no foreign personnel are employed. (This is prior to the handing over of the management of NTC mills to foreign firms.) All managerial and other posts are staffed by nationals. In the case of technological imports, the average degree of assimilation achieved between 1973 and 1977 was 49%. A closer examination of the gross incomes generated and the foreign exchange utilization by the NTC between 1973 and 1977 indicates that for every Rs100 (U.S.$5.57) of value-added, foreign exchange equivalent to approximately Rs133 (U.S.$7.41) was utilized.

In spite of the deficit supply position in the market (1967-1976), the mill sector never reached even 50% of its total rated capacity. Although foreign exchange shortage was partially responsible for this, the main cause seems to have been the high incidence of machine downtime. This resulted, among other things, from the low level of absorption of adopted technology. The low level of capability in engineering technology resulted in inadequate plant maintenance, frequent machine breakdowns, and the consequent low level of plant capacity utilization. In the case of the NTC, therefore, the actual value-added was as low as 37% (on average during 1970-1977) of its potential.

If the benefits of adopting imported technology for economic development are to be optimized, adequate policy changes and incentive measures are required: (1) ensure the development of a sound technological engineering base, (2) promote exportation of the finished product, (3) encourage local manufacturing of intermediate inputs, and (4) ensure optimum utilization of the productive resources.

Using the terminology adopted in the study, this requires the promotion of the degree of absorption, diffusion, and assimilation of imported technology. Problems faced by the domestic textile industry after import liberalization in 1977 indicate that the domestic industry has still not reached a stage at which it is able to compete with imported products within a system of free trade. Some protection is still required but
the system of protection provided has to be well planned to promote growth of efficiency. One of the main factors contributing to poor competitiveness of local textile product is their relatively poor quality. This probably requires modernization of existing production facilities. During a transitional period of protection, the existing industry has to be encouraged to provide its own resources, i.e., capital and foreign exchange, to undertake plant modernization, particularly in the case of public sector firms.

The industry seems to have capable and knowledgeable technical people but the autonomy of decision-making given to them, in the public sector of the industry, is minimal, not only in the choice of technology but also in the day-to-day management of the mills under their authority. In order to give them greater responsibility there has to be a change in the attitudes of those in power. Introduction of incentive schemes to promote innovative decision-making is also required.

Manufacturing activity in any particular area has its linkages with productive activity in other areas. Promotion of these linkages, particularly the backward linkages, is necessary to optimize the benefits of expanding any industry. Close coordination of related activities is, therefore, necessary. This often requires, as shown in the present study, institutional reforms. In Sri Lanka, there is a Textile Industries Ministry, but cotton growing continues to be under the authority of the Ministry of Agricultural Development. Necessary institutional linkages between these two ministries and other relevant bodies are indispensable if industry linkages are to be made use of for more rapid and sustained industrialization.

Comments: Luke Kho

This paper has a very informative section on the development of the textile industry in Sri Lanka from the historical perspective, particularly due to its suggestion that its evolution is a result of the interaction of productive forces from various power groups: namely, colonial, British capitalist, “comprodore bourgeoisie,” etc.

The paper also focuses on the growing literacy of and shrinking employment opportunities for its vast labour force as a consequence of the country’s “failure to develop an industrial technology infrastructure.”

The definitions of ADIT require more specification and the subsequent quantification requires greater methodological linkages and logical basis.