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# Industrialisation and Thinking on Technology

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## INTRODUCTION

Industrialisation is an issue that has loomed large in thinking about development issues, at both academic and governmental levels, over the past four decades. This period has seen differences in view over the *appropriate* policy regime. The dominant view until the early 1970s was that of Import Substituting Industrialisation (ISI). This was then challenged by the advocates of Export Promotion (EP). The last ten years have witnessed a substantial amount of debate over the relative merits of these approaches and their policy implications. One theme that has permeated the debate about industrialisation is the concern with technology and technology policy which focus on several matters :

- The importance of industrialisation in the development process,
- The debate on ISI and EP, and
- The role of technology and technology policy.

## IMPORTANCE OF INDUSTRIALISATION IN THE DEVELOPMENT PROCESS

The customary starting point in the case for industrialisation is a series of observations:

- That many historical countries have over a long period of time been heavily dependent for income and employment on the agricultural sector,
- That the historical process of growth in the now developed economies has involved, with few exceptions, a relative contraction in the role of the industrial sector,
- That in many economies the pattern of agricultural production and export reflects not simply the operation of comparative advantage but also the influence of the colonial experience, and
- That the prospects for achieving more rapid and sustainable rates of growth through development of the agricultural sector are limited.

This last observation has its roots in the *export pessimism* generated by Nurkse. Writing in the 1950s, Nurkse felt that the prospects for increased agricultural exports were constrained by:

- Low income elasticity of primary products,

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- Low price elasticity of demand for primary products,
- Low population growth rate in developed market economy (country),
- Development of synthetics to replace *natural* products, and
- Protection in developed country's market.

This *export pessimism* was reinforced by the Prebisch/Singer thesis on deteriorating terms of primary products as against manufactured goods. The conclusion drawn from the Nurkse and Prebisch/Singer thesis was that developing countries should shift their productive structures towards the industrial sector. This greater emphasis on industrialisation was accompanied by analysis of the inter-relationships between the industrial and agricultural sectors by Lewis and Chenery.

In the Lewis model we find the new standard characterisation of developing countries with two sectors. The first is traditional rural sector with zero marginal productivity of labour which leads Lewis to develop a model on *surplus* labour; and the next is a modern urban industrial sector with high marginal productivity.

This model stresses the transfer of labour from agriculture to industry and the growth of output and employment in the industrial sector. The absorption of labour from agriculture continues until the surplus labour is employed in industry. The process of industrial expansion is fuelled by the surplus generated for industrialists as a results of rising productivity but constant real wages (resulting from the availability of labour supply). This surplus is reinvested to expand the capital stock.

The Chenery-type *stages* model is predicated more directly on the structural transformation which was evident in the growth of today's developed countries. This approach identifies saving and investment as critical but goes beyond the Lewis-type model to specify both domestic and international constraints on growth and development. Domestic considerations include the resource endowment, population size and government policies. At the international level, the constraints include the limited markets for exports, the availability of required imports, access to foreign capital and access to foreign technology.

Structural transformation, increasing the share of the industrial sector in both total income and employment, increasing employment level and higher average labour productivity, and higher level of investment are common features to both the models.

The 1950s and 1970s saw a very heavy reliance on import substitution as the means to achieving structural transformation, and the most frequent policy approach was that of tariff protection, often combined with over valued exchange rate regimes.

## IMPORT SUBSTITUTING INDUSTRIES (ISI) AND EXPORT PROMOTION (EP)

The ISI framework is based very heavily on the *Infant Industry* case for protection, i.e. that by enjoying tariff protection domestic industries can mature to become able to compete with foreign suppliers. In achieving this maturity two factors are of great importance:

was that of accepting a continuing dependence on the standard prescription of real wage reductions as the means of achieving competitive standing.

This debate has highlighted the need to consider carefully the development of indigenous technological capability. Again, however, it would be misleading to believe that an argument raised in the context of the market philosophy of EP necessarily has a solution that lies solely in the market mechanism.

## CONCLUSION

With the above discussion following hidden factors surfaced with technology issues:

- Technology transfer is considerably more complex than simply importing a technology from abroad. Account has to be taken of its appropriateness in the light of factor endowments and demand patterns,

- Technology has to be suitable to the skill and knowledge base of the economy and suitability of skill and knowledge have marked variations with level of education,

- Much work is yet to be done on the development of indigenous technological capability and there has to be greater effort directed towards understanding how this capability can be promoted.

In addressing issues such as these, attention should be paid to:

- Evaluating a country's previous experience with respect to technology transfer and adaptation,

- Examining the terms and conditions under which technologies are made available by multinationals and through aid programmes,

- Setting out a country's industrial objectives in terms of what is desirable and what is feasible in the light of available and projected skill,

- Evaluating the spectrum of technologies for particular activities, and

- Seeking to promote the growth of indigenous technological capability.

## SELECTED REFERENCES

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Nurkse, R. (1959), *Patterns of Trade and Development*, Stockholm, Almquist Wicksell.

the scope for reconsidering the range of technology options which exist either for part of a process or for the entire process.

Out of this debate emerged an important consideration namely the extent to which countries receiving aid or capital inflow from multinational companies have, in practice, any room for manoeuvre in their choice of options.

The discussion of *appropriateness* also highlighted the issue of adaptation and innovation of technologies. This issue had already emerged in a particular form in the product cycle theory which assumed that :

- Innovation in products and processes takes place in developed economies with an innovating economy enjoying an initial advantage in trade in that product,
- Information on the product and its production processes is then to other developed economies which becomes net exporter of the product, and
- The technologies are then diffused to developing countries where lower wage cost will enable these countries to replace the developed economies as exporters of the product.

The emphasis in this approach, as in much else, is on cost reduction as a means to achieving competitiveness in the developing countries. The source of the new technology remains in the developed word. It has long been recognised that technological innovation is a powerful source of competitive advantage. This is an idea that has been written about by economists over the past two hundred years. In recent decades the presumption has been that innovations are the almost exclusive province of the developed economies and that the *best* most developing countries can hope to achieve is some form of adaptation of technologies developed elsewhere.

In large part, the argument that innovation is the province of the developed world revolves around the view that higher income levels will generate demands for new products and that low income economies are still attempting to cater for demands for old products. In new industries, such as electronics and pharmaceuticals, there is a very high degree of technological dynamism. In older industries, such as textiles, there is less innovation.

During the period of ISI domination, a great deal of attention focussed on the monopoly power which control over technology bestowed on protected firms. Where these firms were multinationals, there were great fears about the extent to which practices such as transfer pricing and repatriation of profits allowed multinationals to extract economic surplus from developing countries and about the perpetuation of technological and more general economic dependence.

With the shift to EP, the ability to survive in highly competitive international markets came to the fore. The pressure to be competitive was regarded as placing a high priority on technological dynamism as a source of competitive strength. For those economies without a technologically dynamic industrial sector the alternative option

- That by excluding foreign supplies from the domestic market, the conditions are created under which domestic firms can achieve economies of scale and associated cost reductions, and

- That through experience of producing new products and using new technologies, management and workers can become more productive, i.e. there is *learning by doing* this again involves cost reductions per unit of output.

In essence, the infant industry argument suggests that trade pattern and comparative advantage can be altered. ISI begins with the substitution of previously imported simple consumer goods and manufactures. In the long run, protection is expected to encourage goods previously imported. There is, therefore, a dynamic time element to the infant industry argument. To a great extent, the trade position enjoyed by certain economies in international trade is seen as a consequence of their earlier entry into the market rather than any inherent advantage.

ISI is taken to be an inward looking approach with restriction on imports, the promotion of domestic industry and control on multinationals. In contrast, advocates of the outward looking EP strategy stress:

- The efficiency and competitive benefits of being closely integrated with the international economy,
- The *distortions* created by protective measures within the domestic cost and price structure,
- The bureaucratic costs associated with organising import control and control over multinationals, and
- The advantages of trading on very large international markets rather than seeking to cater for much smaller domestic market.

Much of the impetus for and resurgence in interest in EP strategy, that took place during the 1980s, reflected a shift in policy in many economies towards more *market orientated* measures. Indeed,developing countries originated in the World Bank's advocacy of the merits of markets. Throughout the 1980s the Bank's series of Structural Adjustment Programmes almost invariably made financial resources available only if certain policies were adopted. These policies included abandoning or reducing government subsidies to different activities, reducing the scale of the civil service, privatisation, and reform of tax and pricing policies, including the *correction* of overvalued exchange rate.

The line taken by the World Bank was reinforced by a substantial number of academic studies which seemed to provide clear weight of evidence in support of the view that countries with more EP orientated strategies experienced faster rates of growth. A number of important objections can be raised with respect to the validity of these studies (Sheehey, 1990 and Singer, 1988).

Moreover, there is, of course, no simple ready answer to which approach is the more attractive. The advocates of EP strategies point to the success achieved by Korea, Taiwan, Hong Kong and Singapore. These are by no means, however, *free market*

economies. Rather they have practised strategic intervention in different sectors. One important consequence of their success, however, is that the prospects of others being able to follow in their footsteps are reduced by the increasing protectionism of the developed countries against manufactured exports from developing countries.

What does seem likely is that as policy makers and institutions start to recognise the limitation of export promotion as a solution for more than a handful of developing countries, the pendulum of fashion will swing once more back towards the infant-industry case for protection.

## THE ROLE OF TECHNOLOGY AND TECHNOLOGY POLICY

Let us fit the question of technology into this discussion of industrialisation and policy approaches.

In the 1950s and 1960s the concern was with increasing the rate of investment. This was seen as critical to the prospects for success. Nurkse, for example, in his related writing on *vicious circles* argued that the increased investment might come from either domestic or foreign sources. This suggests an absence of great concern about the nature of the investment.

By the late 1960s, however, it was clear that the investment which was taking place was proving to have no great impact in many economies and was certainly not producing results along the lines suggested by Lewis and Chenery. Problems of unemployment were not disappearing in the rural areas and urban unemployment was rising. In addition, there were upward pressures in the urban areas on wages for those involved in industry and the civil service.

One response to this was to identify a problem in terms of human capital that domestic skill formation was not sufficient to prevent constraints in key areas.This response resulted in foreign aid programmes shifting from the provision of financial aid to a greater provision of technical assistance. Such a response, in effect, took the existing technology forms as given and sought to equip the labour force to work with those technologies.

A second response was to consider the *appropriateness* of technologies and products. A basic feature of the Lewis and Chenery models is recognition of the labour abundance and capital shortage in developing countries. The failure to resolve problems of unemployment was seen in terms of a dependence on imported technologies which were developed in and for economies with quite different resource endowments. Much attention was directed, therefore, to considering alternative and intermediate technologies skill of local labour forces.

Along with this came analysis of product and the technology involved at different stages of production. Processes were broken down into their various stages to investigate the extent to which labour could substitute for capital. Where a part of production process involves, for example, the generation of a high temperature, that part of the process may offer little scope for factor substitution. Nevertheless, there is

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